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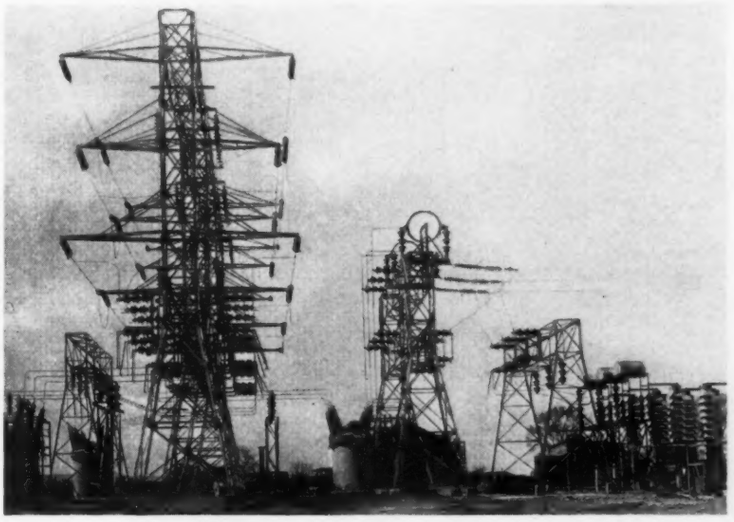

Oneida Substation
New York Power & Light Corp.

OCTOBER 25, 1930

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ELECTRICAL WORLD

for the Week Ending

October 25, 1930

I cannot recognize the right of any group or class of customers to be served at a loss or to have electric service kept available to them without paying for it.

M. S. SLOAN,
President
New York Edison Company.

Hydro pushed to aid unemployed

Submetering again ruled out in Jersey

Danville, Va., rejects bids once more

California tries new sales policy

—BROAD RIVER POWER Company to have rehearing on Columbia (S. C.) railway case. U. S. Supreme Court to give reconsideration of right to abandon unprofitable services.

—CANADA pushes 2,000,000-hp. hydro projects to aid unemployment situation. Contributing industries seen as benefiting most.

—JOHN FRITZ MEDAL, highest honor of engineering America, awarded for 1931 to Rear Admiral D. W. Taylor, chiefly noted for work in marine architecture.

—DANVILLE, VA., coyest of municipalities, after luring bids for city plant from utilities for third time, rejects $4,500,000 offer.

—FEDERAL TRADE investigation will be resumed next month with an as yet unnamed holding company on the block. A slow and painful business this.

—SUBMETERING hit in New Jersey. Court of Errors and Appeals backs up Supreme Court decision by refusing to compel Public Service Commission to order master meter installation.

—INDUSTRY LEADERS at Lehigh University conference discuss with educators the relations of engineering colleges and industry. Broader men, not specialists, is keynote.

—NEW YORK CITY rate hearing must be limited to rate cut, says Commissioner Maltbie, excluding rate of return and valuation questions.

—STREET - LIGHTING CODE of Illuminating Engineering Society proposes minimum recommendations for light-, medium- and heavy-traffic thoroughfares.

NEWS OF THE WEEK

Courageous Spirit Pervades N.E.M.A. Meeting at Old Point Comfort

THREE HUNDRED AND FIFTY members of the National Electrical Manufacturers' Association attended the annual meeting of that body, held at Old Point Comfort, Va., on Monday to Thursday of this week. Section meetings covered the several divisions of manufacturing activity. A generally courageous attitude toward the business situation was exhibited, and President C. L. Collens in his address stressed the point that a poor business period called for courage and self-restraint in dealing with other manufacturers and with the trade. He reported that the N.E.M.A. was progressing steadily and gave formal expression to his own code of business conduct. This will be printed in an early issue of the ELECTRICAL WORLD.

In a notable address on the business situation Dr. Virgil Jordan traced the development of the present situation and called for vigorous action by business men against the deflationists who now largely dominate the credit situation. He said that general business suffered from using too short a time in business planning. A constant cycle of two good years and one bad year for business indicated that business planning should be based on three to five years in order to smooth out the depressions and booms. In his opinion business would continue to drop until the first of the year, then flatten out and revive gradually in the spring.

A. W. Berresford, managing director of the association, in his annual report discussed N.E.M.A. problems and progress. The work on statistics, cost accounting and standards is progressing steadily and section activities are becoming better co-ordinated. Earl Whitehorne presented the James H. McGraw awards for outstanding service in the manufacturing industry to Lee F. Adams for his work on standards and to R. W. E. Moore for work on codes.

▼

Will Power Board Decide to Act or Not to Act?

WHETHER THE INCUMBENT MEMBERS of the Federal Power Commission will undertake to decide the New River case and to pass on the controverted Zellerbach application for an Alaskan site, or whether they will allow those matters to go over until the new commissioners take office, will be known in the near future. Each of these cases is ready for action.

Pursuant to the opinion of the Attorney-General that the federal government has only limited jurisdiction over projects on non-navigable tributaries where no government lands are involved, the Appalachian Electric Power Company has applied for the minor-part license which will contain the conditions intended to safeguard navigation on the Kanawha River, of which New River is a tributary. To protect navigation the company would be required to release designated quantities of water when the gage at the upper navigation dam falls to a certain level.

It is probable that certain members of the commission's staff will urge the commission to reconsider the action it took in 1926 in finding New River non-navigable. In the meantime Charles A. Russell, solicitor for the commission, has filed a brief in which he registers emphatic dissent from the Attorney-General's decision and reiterates his view that its acceptance will render the whole federal water-power act "merely an idle gesture."

The Zellerbach application covers a proposed development in the Tongass National Forest in southeastern Alaska. The power is to be used in the production of wood pulp for the manufacture of newsprint paper. Incidentally, the government's ownership of the land covered by the application is being questioned, and an injunction is being

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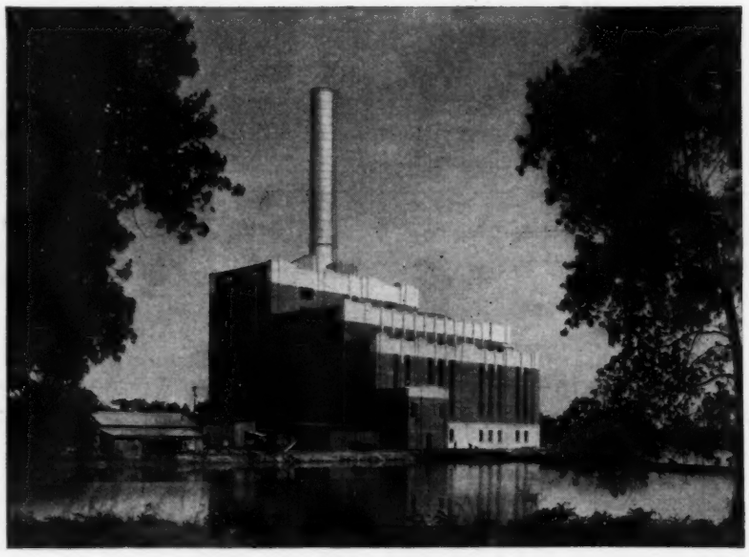
BELLE ISLE POWER STATION READY



Thirty thousand kilowatts has been added to the generating capacity of the Oklahoma Gas & Electric Company by the completion of this station at Oklahoma City. Well designed and situated, landscaping and floodighting will enhance its attractiveness.

sought. The members of the commission and the executive secretary have been summoned to appear November 6 before the Supreme Court of the District of Columbia to show cause why an injunction should not be issued.

▼

Winning Bid Made Public for Hoover Dam Power

THE SOUTHERN SIERRAS POWER COMPANY'S successful bid to furnish power for the construction of Hoover Dam, announced last week, was considerably lower than the bids submitted by the Inland Utilities Company and the Southern Nevada Power Company. The Southern Sierras Power bid 1.729 cents per kilowatt-hour for delivery of power over a single transmission line from San Bernardino or Victorville, Calif., plus 0.280 cent per kilowatt-hour to cover the cost of an emergency standby plant near the dam site. The bids of the Inland Utilities Company and the Southern Nevada Power Company were 2.444 cents and 2.802 cents respectively. Their proposals involved construction of a temporary plant near the dam site to furnish all the power required.

▼

California Edison Alters Merchandising Policy

ADJUSTMENT OF THE CONFLICT over merchandising practices of the Southern California Edison Company which has been waged between that company and the southern California division of the Association of Electragists seems in a fair way of speedy realization if an arrangement now being tried out in the Long Beach district achieves the success for which both parties to the dispute hope. The plan involves virtually a complete discontinuance of utility merchandising activities in Long Beach and a more satisfactory plan of co-operation with dealers in the rest of the Southern California Edison Company's territory. A joint advertising campaign opened October 20.

▼

Lac Seul Storage Will Help Manitoba Shortage

POWER SHORTAGE arising from drought, which has seriously inconvenienced the city of Winnipeg during the past month and led to the calling of a meeting of the Joint International Commission, controlling the Lake of the Woods, will, it is claimed, be largely alleviated by the recent release of the Lac Seul storage basin. These waters take about two weeks to reach the power plants on the Winnipeg River. Their arrival will, it is hoped, replenish the supply of both the Winnipeg Electric Company and the Winnipeg Hydro. The former had been operating its steam standby plant. Permanent relief will come with the completion of the company's Seven Sisters development and the city's new plant at Slave Falls.

▼

Supreme Court to Rehear Columbia Utility Case

AFTER HAVING HELD in a previous decision that the franchise of the Broad River Power Company prohibits its abandonment of street-railway service in Columbia, S. C., the United States Supreme Court, upon the application of the company, has consented to rehear the case, and this rehearing has been set for November 24. Last term the court held that a corporation operating an electric railway and an electric power and light company under an inseparable franchise from the state may constitutionally be forbidden by the state to abandon the railway while continuing the other business. It was claimed by the company that a heavy loss was being incurred annually by the operation of the street-railway service. (ELECTRICAL WORLD, May 24, page 1015.)

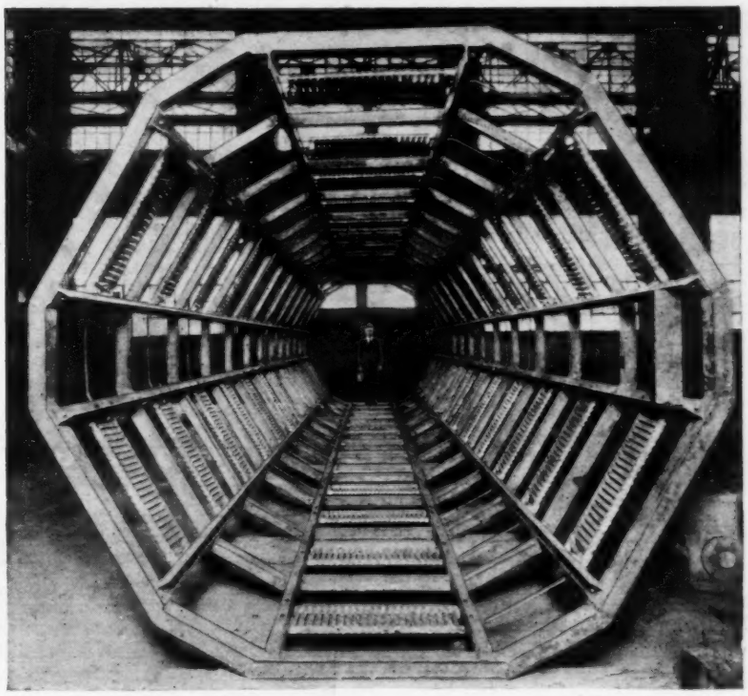
▼

High New Jersey Court Upholds Submeter Ban

ONCE MORE the New Jersey Board of Public Utility Commissioners has been upheld by the courts in its refusal to compel the Public Service Electric & Gas Company to install a master meter in an East Orange apartment house. Sustaining the decision of the State Supreme Court (ELECTRICAL WORLD, November 23, 1929, page 1051), the Court of Errors and Appeals ruled against the appellant (Sixty-Seven South Munn, Inc.) at Trenton on October 20.

The real estate firm had agreed with its tenants to supply them with electricity through submeters. The basis of the decision by the commission was that the property owner, not being a public utility, would not be under commission regulation as to service or rates. Possible unregulated competition was seen.

PIPE-COATING UNIT FOR ELECTRIC HEATING



The virtue of electric heating, that its effect can be uniformly applied over very large surfaces, is shown by this unit, which is used by the Taylor Forge & Pipe Works, Cicero, Ill., in pipe-coating work. Its capacity is 180 kw. at 440 volts, three-phase. The coating tank it surrounds is 8½ ft. in diameter and 40 ft. long and contains 90 tons of coating material.

▼ ▼ ▼

Brooklyn Edison Adds 110,000-Kw. Generator

AWAY IN ADVANCE of the date originally set, the sixth generating unit in the Brooklyn Edison Company's Hudson Avenue station—a 110,000-kw. Westinghouse machine—has just been placed in operation, bringing the total capacity of that station to 450,000 kw. The entire unit, including the steam turbine, condensing equipment and electric generator, installed with all its electric and steam auxiliaries, cost approximately $7,000,000.

This machine is of the same capacity and similar in its main features and equipment to the fifth unit in the same station, also of Westinghouse make, which was placed in operation in September, 1928. Remaining space in the Hudson Avenue station will be occupied by two 160,000-kw. units recently ordered from the General Electric Company. When they shall be installed the capacity of Hudson Avenue will be 770,000 kw., putting it among the largest few in the world.

▼

Federal Trade Inquiry Will Resume Next Month

PUBLIC HEARINGS in the Federal Trade Commission's utility inquiry will, the commission expects, be resumed early in November, when another large holding company will undergo questioning. An interim report transmitted to the Senate October 17, the first since July 15, shows that the fire of August 30, which wrecked the building formerly housing the commission, destroyed reports prepared for introduction in public hearings relating to eight companies concerning which hearings had not been held up to that time. Other losses in the fire include field analysis sheets as well as exhibits pertaining to five other companies.

Much time and expense have been required and more will be needed to replace the lost documents, but prosecution of the investigation, as ordered by the Senate, has proceeded without substantial interruption.

▼

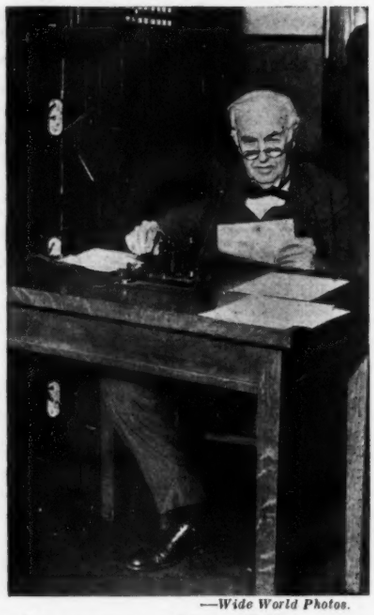
Winter Troubles Begin in Upstate New York

A PRE-WINTER STORM which swept over the lake region south of Buffalo last Saturday and Sunday did considerable damage in the rural sections to wires and poles and temporarily cut off service of the New York State Electric & Gas Corporation, which serves a territory of about 1,500 square miles in upstate New York. The snow was four feet deep in many places and the wind velocity was from 40 to 50 miles an hour. Snow on the trees became so heavy that limbs were broken and wires came down with them. Seventy-five extra men were added to the maintenance crew, and all worked from 48 to 60 hours without rest until service was restored.

One result of the October blizzard was that many requests came into the power company's office to prune the trees that carry wires. Heretofore the company's efforts to do this have met with much resistance.

▼

HIS LAMP BORN JUST 51 YEARS AGO



—*Wide World Photos.*

Age cannot wither Edison, nor custom stale his infinite variety. It is seldom, however, that the snapshotters catch him wearing spectacles.

▼

Rocky Mountain Men Meet at Albuquerque

ALBUQUERQUE, N. M., WAS THE SCENE of the annual convention of the Rocky Mountain Division of the National Electric Light Association, with which the now amalgamated public utility associations of Colorado, Wyoming and New Mexico are allied, on Monday, Tuesday and Wednesday of this week. President Jones and Public Relations Chairman Reid of the national body addressed the convention, as did J. A. Clay, president of the division; President J. F. Zimmerman of the New Mexico University and H. S. Ives. Mr. Jones' topic was "If We Don't, the Politicians Will." It was aimed against "political racketeers." James B. Wootan addressed the banquet on "Miracles."

A telegram was received from Edison in response to one congratulating him on the fifty-first anniversary of the invention of the incandescent lamp.

Eight Indian tribes participated in a pageant and aboriginal outdoor ceremony, during which President Jones was made a member of the Navajo tribe.

John E. Loiseau, secretary Public Service Company of Colorado, was elected president of the Rocky Mountain Division, N.E.L.A., and George E. Lewis of Denver will head the tri-state utility association.

▼

Sloan Cross-Examined in New York Rate Case

REPRESENTATIVES OF NEW YORK CITY, real estate associations, submetering organizations and industrial engineering firms cross-examined President M. S. Sloan at a hearing before the New York State Public Service Commission on Thursday and Friday of last week, upon the proposed rate reduction.

Only the determined insistence of Chairman Milo R. Maltbie against drawing out the case and his rigorous exclusion of questions of rate of return upon property or investment prevented the hearing from including those subjects. Tabular material submitted as addenda to Mr. Sloan's original letter of August 1 was excluded from evidence.

Chairman Maltbie professed his inability to appreciate the distinction made by Mr. Sloan and the company between consumers served directly and those obtaining energy through submetering organizations, and Mr. Sloan was unable to convince him of its propriety. Upon the protest of Judge Ransom, counsel for the companies, that the subject involved a matter of law the matter was inconclusively dropped.

Discussion of coal clauses, long active in New York City utility rate problems, was again introduced over repeated protests of Edison counsel. Mr. Sloan testified that wholesale rates and coal clauses not affected by the present offer would be and were being studied with a view to readjustment. Representatives of large consumers offered to withdraw another case now pending before the commission were the coal-clause terms of the present proposal extended to wholesale classifications.

Frankly conceding that he had made no attempt to determine the attitude of the public toward the institution of the fixed-charge principle in New York and replying to the inquiry regarding it, "Do you think that complaints to the

commission will be decreased?" with "Not substantially," Mr. Sloan repeated once more his opinion that the proposal would not only bring lower rates to those making use of energy but would lead to future reductions.

A distinction between lower rates and lower bills was repeatedly drawn by protestants and Mr. Sloan—the small user, to the extent of more than 50 per cent of the company's customers, being adversely affected in the latter respect on the basis of present consumption, but standing to benefit in the former respect by increasing his use of light and domestic appliances to accord with present-day standards.

▼

Municipal Plant Voted for Vernon, Calif.

AT A RECENT SPECIAL ELECTION in the city of Vernon, Calif., $3,900,000 in bonds was voted to construct a municipal power plant and distribution system. Vernon is an industrial city of less than 3,000 population almost wholly surrounded by the city of Los Angeles. One man is said virtually to control the city, and of about 125 votes in the community, 67 were cast at the special election, 64 for and three against the bonds. There is a total load of approximately 50,000 kw. in the city, and it is the avowed intention to serve this by Diesel-engine-driven generators. Possibly the primary purpose of the bond issue is to use it in an attempt to obtain a reduction in rates of the private utility now serving the city, the Southern California Edison Company.

▼

Salem (Ore.) Municipal Project Fails in Council

A STEP TOWARD MUNICIPAL OWNERSHIP of an electric power system for Salem, Ore., was defeated by the City Council recently. An ordinance which passed its first and second readings but was defeated on the third reading provided for submitting to the voters at the November election a proposal to issue $5,000,000 in bonds to acquire a power system. Salem is served by the Pacific Northwest Public Service Company, Portland.

An ordinance was passed which provides for a referendum on the question of whether or not the city shall file an application with the State Engineer for a permit to appropriate the waters of the North Santiam River and Marion Lake for the purpose of developing hydro-electric power.

Canada's Hydro Program An Aid to Employment

AN IMPORTANT CONTRIBUTION to employment in Canada is being made by the many large hydro-electric power developments on which work is proceeding this fall and winter. This affects not only men actually employed at the various developments and by the manufacturers of large equipment but also the lumbering, cement and other industries.

Hydro construction programs now in progress envisage an ultimate output of more than 2,000,000 hp., of which the more notable developments include: British Columbia, 188,000 hp. at Ruskin and 600,000 hp. on the Bridge River; Manitoba, 40,000 hp. at Seven Sisters Falls on the Winnipeg River and 12,000 hp. by the city of Winnipeg at Slave Falls; Ontario, 224,000 hp. at Chats Falls on the Ottawa River, 54,000 hp. on the Nipigon River and about 25,000 hp. in northern Ontario in the mining region; Quebec, 500,000 hp. at the Beauharnois development on the south shore of the St. Lawrence River between Lake St. Francis and Lake St. Louis, 160,000 hp. by the Shawinigan company on the Upper St. Maurice, and the large works of the various plants on the tributaries to the Ottawa River from its north side.

▼

Copper Versus Aluminum in Ontario Line Building

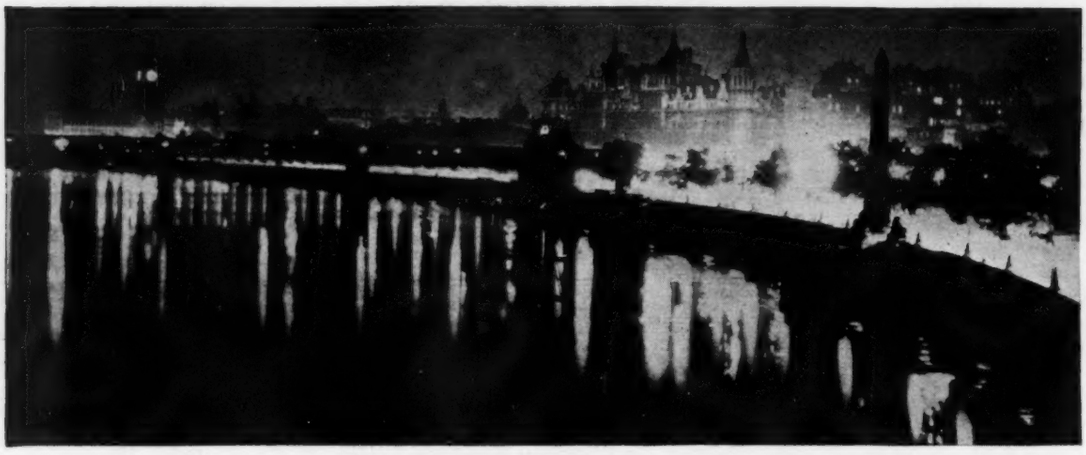
IT IS REPORTED that a competitive battle is in progress between two large Canadian industries in connection with the choice of materials for the proposed new hydro-electric power transmission line between Abitibi Canyon and Copper Cliff, Ontario. In view of the prevailing low prices for copper and the fact that the line has been planned chiefly to serve the copper-nickel industry, the assumption was that copper would be used. Now it appears that aluminum is being seriously considered. The total length of the line from Abitibi Canyon to Sudbury is about 240 miles. If copper is used, about 2,500 tons would be involved in orders for cable.

▼ ▼ ▼

CHACE AND HARRIMAN ARE HONORED

Tribute to the "judgment, sagacity and courage of Malcolm Greene Chace, together with the resourcefulness, energy and industry of Henry Ingraham Harriman," is inscribed on a bronze tablet dedicated on October 15 at the Harriman Dam of the New England Power Association at Whitingham, Vt., in the presence of 30 associates of these pioneers. Mr. Harriman is seen in the foreground.

ON THE BANKS OF THE RIVER THAMES AFTER NIGHTFALL



The Thames Embankment in London is thought to afford the best example of thoroughfare lighting in the United Kingdom. Wembley 1,500-watt G. E. lanterns are suspended in pairs at a height of 30 ft. Cleopatra's Needle is seen in the foreground and the House of Parliament on the extreme left.

▼ ▼ ▼

Wisconsin Public Service Wins First Safety Prize

FIRST PRIZE in the nation-wide accident-prevention contest among combined electric and gas utility companies was awarded by the National Safety Congress at its recent convention to the Wisconsin Public Service Corporation, Milwaukee. The first prize in the electric group of companies supplying only electric service and employing fewer than 500 men was awarded to the Mississippi Valley Public Service Corporation, Winona, Minn., also a Byllesby property. This is the second year that the Wisconsin Public Service Corporation has won this contest, it being the first company to win the trophy twice in succession. An average of 1,300 men employed by the company worked 1,750,000 man-hours with only eight lost-time accidents.

▼

White River Hydro Plans Are Advanced a Stage

PERMITS FOR CONSTRUCTION of dams and hydro-electric plants in north Arkansas for development of the Upper White River and two of its main tributaries, involving an ultimate estimated expenditure of $43,000,000, have been granted by the Arkansas Railroad Commission to the White River Power Company of Pine Bluff.

The plans of the company, as outlined before the commission, call for three dams and generating plants. Plant No. 1 will be 5½ miles north of Cotter, Ark. From this point an artificial lake covering 40,000 acres will extend to near Forsythe, Mo. A second plant and lake covering 29,000 acres will be on the North Fork of White River, and a third on the Buffalo River, where a lake of 11,000 acres will be created.

▼

Oklahoma Court Rules Out Diesel-Plant Plan

ANOTHER ACTION raising the question whether a municipality can purchase a Diesel-engine generating plant on the installment plan, such installments to be paid out of earnings only, without the total obligation being charged against the statutory limitation of municipal debt, has recently been decided by the Oklahoma Supreme Court (Zachary vs. City of Wagoner) in the negative. Other high state courts have made conflicting decisions. (See ELECTRICAL WORLD, July 26, page 149.)

In the Oklahoma case city officials of Wagoner, without obtaining the taxpayers' consent, entered an agreement to pay for the equipment from the saving in the cost of operation of the Diesel plant as compared with the present steam plant over a period of 52 to 120 months. The opinion states that the constitution requires municipalities to carry on their operations upon the "cash or pay-as-you-go plan." The revenues of each year must take care of the expenses of each year, and any liability sought to be incurred by contract in excess of such current revenue is void unless it be authorized by a vote of the people and within statutory limits.

Danville, Va., Keeps Plants Thrice Voted On

DANVILLE (VA.) VOTERS went heavily against an offer to sell the city-owned gas and electric plants to the Western Power, Light & Telephone Company of Missouri, put to a referendum on October 14. The vote was 1,517 for and 2,548 against. Under the proposal the company offered a cash price of $4,300,000 and promised to donate $100,000 for a new-industries fund, as well as to double the present steam generating capacity at a cost of $600,000.

This was the third time since 1926 that the Danville voters had gone to the polls on the same issue. In December, 1926, there was a negative response to an offer by the Appalachian Electric Power Company, the majority being 251. In June, 1927, the Appalachian company made a higher offer, but this, too, was rejected, by a majority of 212.

▼

Argument on Klamath River Project Heard

AT A HEARING before the Reclamation Commission of Oregon on the application of the California-Oregon Power Company for a permit to undertake a hydro-electric project on the Klamath River, the company declared itself ready to start work immediately on the first 34,000-hp. unit of the plant, involving about $4,000,000. Eventually $27,000,000 may be expended.

The Attorney-General of the state

opposed the application on technical grounds, and protests against it were made by the Klamath Irrigation District and the Municipal Ownership League of Portland, but 100 civic officials and taxpayers of southern Oregon asked that it be granted. Decision was reserved, but, whatever it may be, so many legal angles are involved that the case seems destined to go to the courts.

▼

Benefits of Advertising Recounted by Utility Men

INCREASED SALES of from 15 to 50 per cent in household appliances have resulted from the maintenance of general advertising appropriations by public utility companies. This was revealed at the annual fall conference of the Public Utilities Advertising Association, held at Atlantic City, N. J., on October 13, when President Irving M. Tuteur of Chicago called upon the advertising representatives of the leading public utility companies to report on the results obtained from their 1930 advertising expenditures. The consensus of opinion was that the advertising appropriations of public utility companies will be maintained at their present level or increased for the year 1931. Mr. Tuteur said that the facts revealed clearly demonstrated that increased advertising, particularly at the present time, results in acceleration of sales.

More than 65 members were present at the meeting, which was devoted largely to informal discussion. Harry Reid, chairman Public Relations Section, N.E.L.A., pointed out the importance of basing the increase of business on a good public understanding.

▼

Coming Meetings

National Electrical Wholesalers' Association—Pittsburgh, Nov. 10-14. E. Donald Tolles, 165 Broadway, New York.

Public Utilities Association of Virginia—Virginia Beach, Nov. 13 and 14. C. O. Robertson, Roanoke.

National Association of Railroad and Utilities Commissioners—Charleston, S. C., Nov. 12-15. J. B. Walker, 270 Madison Ave., New York.

American Institute of Electrical Engineers — Southern District, Louisville, Nov. 19-22; winter convention, New York, Jan. 26-30. F. L. Hutchinson, 33 W. 39th St., New York.

American Society of Mechanical Engineers—New York, Dec. 1-5. C. W. Rice, 29 W. 39th St., New York.

North Central Division, N.E.L.A.—Commercial meeting, Nicollet Hotel, Minneapolis, Jan. 26 and 27; engineering meeting, same place, Feb. 23 and 24. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Midwest Power Engineering Conference — Chicago, Feb. 10-13. G. E. Pfisterer, 308 W. Washington St., Chicago.

James H. Reed Plant Is Formally Dedicated

PASSING HIS HAND over a grid relay tube at the speakers' table during a dedicatory luncheon on October 16, James D. Callery, former president Duquesne Light Company, set in motion the new 60,000-kw. James H. Reed power station of that company on Brunot Island. (See photograph March 8, page 474.) A distinguished company was present, including President John J. O'Brien and Vice-Presidents Halford Erickson, Joseph H. Briggs, R. G. Hunt and R. J. Graf of the H. M. Byllesby company of Chicago; President Frank R. Phillips and Vice-President E. W. Judy of the Duquesne Light Company; A. W. Robertson, chairman of the board, Westinghouse Electric & Manufacturing Company, and E. T. Whiter, vice-president Pennsylvania Railroad.

United States Senator David A. Reed, son of the man for whom the station is named, made the dedicatory address.

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South Amboy Station Goes on Line Next Week

RADIO BROADCASTS OF SPEECHES will mark the dedication of the Jersey Central Power & Light Company's 50,000-kw. steam-electric generating station at South Amboy, N. J., on October 31. A picture of this station was printed in the ELECTRICAL WORLD for August 23, page 336. Speakers announced include Martin J. Insull, president of the Middle West Utilities Company; T. R. Crumley, president of the Jersey Central Power & Light Company, and A. E. Burns, vice-president of the National Electric Power Company. Governor Larson of New Jersey is expected to throw the switch setting the two generators to work.

The new station has been erected at tidewater on the Raritan River, in the center of the company's system. Transmission lines will link South Amboy with both the northern division, centering around Morristown and Summit, and the southern division from South Amboy to Barnegat.

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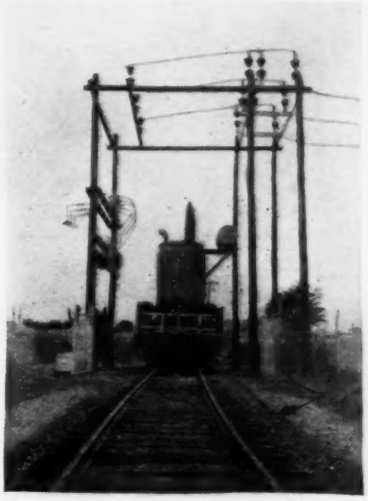
Plant Atkinson Is Dedicated in Georgia

IN THE PRESENCE of more than 2,000 people, the new steam generating plant of the Georgia Power Company, Plant Atkinson (pictured October 11, page 672), was formally opened on Friday, October 17 with appropriate ceremonies. Special trains from Atlanta conveyed hundreds of people to the plant, 10 miles from the city, and hundreds more came by other means. Preston S. Arkwright, president of the company, dedicated the plant, and a response was made by H. M. Atkinson, chairman of the board of directors, for whom it was named and in whose honor a tablet was unveiled. Prominent Georgians in other walks of life also spoke.

▼

SUBSTATION ON WHEELS



Ready to start down the tracks at any moment, this 1,500-kva., 110/13-kv. transformer of the Arkansas Power & Light Company has its home at Montrose, Ark., but its field of usefulness anywhere along the line.

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Power and Navigation on the Guadalupe

ALTHOUGH THE CENTRAL POWER & LIGHT COMPANY of San Antonio has applied to the Federal Power Commission for a license for the construction of a dam and 3,000-hp. electric plant on the Guadalupe River, the project will not be immediately carried out. Since it was broached the matter of making the Guadalupe River navigable to Victoria, and possibly to Cuero, has been considered seriously by United States army engineers. If the river should be made to carry oceangoing vessels as far up as Cuero, the plant, it is understood, will not be installed. There are already three electric power plants in operation on the Guadalupe by the Texas Power Corporation, and, as already reported, new units are being installed by the same interests. The plants already operating are between New Braunfels and Seguin.

Largest Anthracite Breaker

TOTALLY ELECTRIFIED

Aero Service Corporation Photo.

Unit drives, interlocking and automatic control assure flexible operation and systematic plant development in this installation of the Philadelphia & Reading Coal & Iron Company at Locust Summit, Pa. Symmetry of design and logical layout are features made possible by complete electrification and individual drives. **See page 782.**

EDITORIALS

L.W.W.MORROW
Editor

Educators and industrialists

TWO thoughts stood out in the discussion of engineering education at Lehigh University last week. One was the need for industry to support and co-operate with the schools. This should take tangible form by making it possible for college faculties to retain and advance the best engineering teaching and research personnel in the country. Industry is following a short-sighted policy in robbing the faculties of able men instead of rendering it possible for these men to remain on faculties under conditions that make for efficient utilization of their talents in teaching and research.

Research is being taken away from the colleges rapidly by industrial research departments. Yet research is a necessary pedagogical tool in training engineers, and to ascertain the relative economy and efficiency of research as between industry and the colleges such intangibles must be taken into consideration. There should be industrial research, but, in addition, there should be a healthy and growing body of research in the colleges. Conditions are quite critical today, and industry will suffer before long if it does not quit taking both able men and research problems from the colleges. To remedy the present tendency a forcible and constructive co-operative program should be laid out.

A second thought is wrapped up in the unanimous opinion that industry will become more and more technical in future, with a greater degree of specialization and departmentalization. It will have to be staffed by men of engineering training; but, since the colleges can give only the fundamental background, industry will have to follow through with a definite process of selection and training for the recruits that enter its ranks. Some of the larger electrical organizations have made a splendid start in this work, but there is room for great improvement, especially in the process for developing executives as contrasted with the development of technical specialists. The so-called apprenticeship shop course is not the complete answer. Educators can help greatly in developing the most effective process for industry to apply to its own educational work.

But the encouraging note to be found is that engineering education is progressing. The students are getting better training and industry is using them to better advantage. This is encouraging, because nothing is of greater importance to the country than an effective educational system to supply men qualified to carry on the tasks of the present increasingly mechanized world.

The bankers show courage

IT IS encouraging to note that the investment bankers expressed courageous and sound sentiments about the light and power industry at their annual convention last week. They condemned the injection of a power issue into national politics; they said federal regulation was not needed; they said the government should keep out of business, and they opposed the extension of the authority of the Federal Power Commission. These sound and constructive expressions should have a positive influence for good. They show that the bankers have studied the utility business and have the courage to speak when informed of the merits of an industry.

Equally sound were the sentiments that utilities should better their own status through self-improvement. Capital structures should be simplified, pyramiding of companies should be restricted to the basis of economic merit, and concealment of company and intercompany transactions should be

replaced by open publicity. Granted that the industry is moving to eliminate objectionable practices, the bankers as well as utility leaders clearly recognize the need for quick action. There should be no delay in the application of constructive ideas.

Relieving high stress

IT IS sometimes possible to improve high-voltage insulation by including in the insulation wall material which has a definite metallic conductivity. On first thought this statement appears almost paradoxical, yet it is easily understood when two well-known facts are considered. The first is that the usual electric field of an insulating structure is far from uniform and in the neighborhood of the high-voltage conductor is subject to much higher stresses than at more remote points. The second fact is that an electrical conductor free of capacity and inductance will distribute an applied voltage uniformly along its length. It is therefore quite possible to include in an insulating structure, in regions subject to high stress, a conducting substance for a greater or less distance along the lines of stress, which would thus tend to lower the high values near the high-voltage conductor, raising it correspondingly at more remote points; in other words, an equalization process.

These principles are involved in the proposal of a new type of high-voltage underground cable as described by M. Weiset in a recent number of the *Elektrotechnische Zeitschrift*. As is well known, the stress on the insulating wall of such a cable is greatest near the surface of the conductor and rises to higher values the smaller the diameter of the conductor. The condition is further intensified owing to the stranding of the conductor. In order to alleviate this condition it is proposed to surround the central conductor with a greater or less thickness of semi-conducting material—*i.e.*, material that will have a definite, though low, value of metallic conductivity. The result will be an increase of diameter from the standpoint of electric stress, without corresponding increase of the conductivity of the conductor itself.

The material of the conducting layer as proposed is a highly absorbent paper, which in manufacture is thoroughly mixed with metal powder, graphite or other conducting substance. This paper also serves, in addition to the purpose described above, another function, considered equally important by the inventor, namely, that the conducting and oil-absorbing layer acts also as a reservoir for feeding oil into the main wall of insulation, as voids tend to form because of the continued expansion of the sheath under repeated temperature cycles. As this occurs such voids as are formed would be inside the conductor, or inside the conducting paper layer, and so would not be subject to electric stress.

The incubus of distribution costs

ELECTRICITY, like milk and other household commodities, has to bear heavy distribution costs before it gets to the retail consumer. The dairy farmer gets four and a half cents a quart for a product sold to the metropolitan and suburban consumer at four times that price. And, let it be noted, this four and a half cents is much more than the cost of production at the milking pail or the tank of the milking machine. It includes important first stages in distribution and the producer's profits thereon. Coal, delivered in the cellar at $14 or $15 a ton, differs enormously in price from the cost as broken out of the seam. Distribution costs pile up from the moment the mule moves the mine car.

Gasoline for the family car, now as common as household electric service, varies widely in price, according to locality. Beginning not at the refinery but at the well, its distribution costs would be still greater if the fluid were piped to individual homes, with consequent metering, meter reading, billing and collections. Gasoline is a "cash-and-carry" commodity. Each of the commodities mentioned costs more per year than the family's electric bill.

But why multiply cases? The spread between cost to the consumer and cost at the point of origin is one of the penalties we have to pay for the present order of living. Most of us believe it is needlessly large. It ought to be reduced wherever possible. The process calls for analysis, as did the cutting of production costs. It is more difficult because it has to do with the voluntary—at times

willful— actions of human beings more than with machines or sticks of wood.

The electrical industry recognizes the challenge and is meeting it. Falling residential rates bear witness. But there is need for action on the other products and services also, some of which bulk far bigger than electricity's $30 a year in the family operating expenses. The distribution problem should be taken in hand for all commodities and the attack launched along the whole battlefront.

At last—Some agreement on street lighting

DEVELOPMENT of street-lighting practice has been somewhat haphazard. Municipalities, operating companies and manufacturers of equipment, working under limited budgets, and the two former with only local experience, have had a difficult task to keep pace with the increasing exactions of traffic. Expert recommendations have sometimes differed to an extent which has indicated that practice is not well grounded in principle.

A step has now been taken which ought to be of assistance to any one engaged in designing a street-lighting system and which ought also to accelerate the advance of practice. The committee on street lighting of the Illuminating Engineering Society, after four years devoted to study and discussions of fundamentals, has brought forth a "Code of Street Lighting" which contains in simple form recommendations as to the amount of light that should be produced in various classes of streets under various traffic conditions. This code has only recommendatory force, but as such it should have considerable weight by reason of the comprehensive personnel of the committee. It bears the indorsement of representative municipal engineers, utility and manufacturing representatives as well as representatives of the teaching profession, laboratories and the consulting fraternity. It is doubtful whether another group of men of equal street-lighting experience and ability could be got together in the country. Thus the personnel of the committee and the auspices under which the code has been compiled lend weight to its recommendations.

Upon turning to the code one may find stated in simple and definite language the recommendations of this committee as to the size of lamps, spacing, mounting height for light-traffic thoroughfares, medium-traffic thoroughfares, heavy-traffic thoroughfares, business districts, residence streets and highways—all in the form of minimum recommendations for satisfactory results. In many instances it may be desirable to go beyond these recommendations, and the committee so advocates; but in all cases it should be helpful to those designing street-lighting installations to be able to turn to these explicit recommendations of a group of experts to learn the consensus of opinion under conditions prevailing in 1930.

Mitchell backs state rights

ATTORNEY-GENERAL MITCHELL recently issued a sane opinion about the authority of the Federal Power Commission. In effect he held that the commission complied with the intent of the water-power act if it merely dealt with the effect on navigation of water-power developments on non-navigable streams. All the provisions of the act need not be applied, for by inference the states have jurisdiction on many matters covered in Section 10 of the act.

This opinion was rendered in connection with a proposed development on New River by the Appalachian Electric Power Company. The utility refused to accept a license that contained all the provisions of the act and was supported in its stand by state authorities. The appeal to the Attorney-General clarified the situation and may help to get action on deadlocked licenses in other states. There has been too much ambiguity about the respective jurisdictions of the Federal Power Commission and the states.

Some radical comment by politicians has been made about the decision, but any sane analysis shows no cause for public concern. No rights have been denied regulatory authorities; only the division of jurisdiction between federal and state authorities has been more clearly defined. A more rapid development of water powers on non-navigable streams should ensue, for state authorities will act more promptly upon applications and utilities will know more definitely how to get licenses.

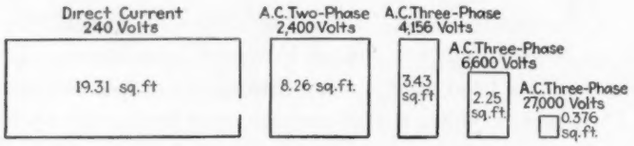
Municipalities Gain

By ABRAM HUSSEY

Distribution Superintendent Brooklyn Edison Company

PROVIDING subsurface space for the many growing utility services and at the same time insuring as little obstruction to vehicular traffic as possible is the problem facing every municipality. Engineers of the various utilities have been co-operating in an effort to reach a solution both economical and adequate.

In electric power supply congestion under the city streets has been materially reduced within recent years by the use of network distribution. In several distinct ways this system has met the city's problem by providing increased electrical service capacity with an actual reduction both in congestion under the street and in the likelihood of occasioning traffic blockades.



Relative duct space for transmitting equal amounts of power at different voltages

These blocks represent the square feet of duct area necessary to furnish 12,000 kw. capacity. The ratio of space required for 240-volt d.c., as compared to 27,000-volt, three-phase, is over 51 to 1.

Under the present system it is possible to transmit as much power as under the old d.c. system in a duct space reduced in the ratio of 51 to 1. This has been made possible by the development of cable capable of operating at 27,000 volts with a high degree of dependability, and of automatic protective devices to clear the cable or other device in the event of failure. An accompanying illustration shows the reduction in duct space permitted by higher voltage distribution. All of this apparent saving, however, cannot be realized in practice for the reason that these higher capacity feeders should not be run in the same large groups as occurred with low capacity feeders. It would not be feasible to expose so much capacity to interruption from one local cause; therefore, lines are built in smaller grouping and a portion of the space saving is sacrificed to safety.

As a direct result of decreased duct space and increased capacities, the number of line manholes and the dimensions of these manholes have been reduced.

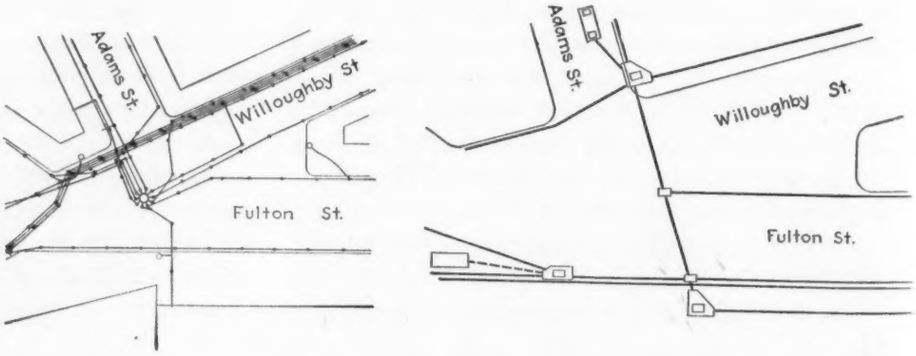
No street openings for new customers

On this system all premises are served at the time of the initial installation, or provision is made for serving them without opening the pavement of the roadway, except for service demands considerably above the average which may require the building of a special service box on the present line. Electric power supply is the only type of public utility service that I know of which makes such full provision in the original installation to guard against future street openings.

Reduction in the number of distribution manholes has been made possible in recent years by the use of transformers of higher capacity. In addition, engineering thought has been directed to the placing of the transformers where they will cause the least obstruction to traffic and the greatest safety to workers. In one particular municipality the preferred locations are in building vaults where such a location is available, in manholes under the sidewalks, on side streets away from the main traffic flow, and in the center of such streets directly above the sewer line, so that no workable longitudinal areas are obstructed.

Street congestion with old d.c. system

Contrast this with the older d.c. tube system of distribution. Conductors were then sealed with insulating compound in 20-ft. lengths of wrought iron pipe at the factory and laid one by one in the ground, the cable



Street space required for d.c. tube type of distribution as contrasted with network distribution

Replacing many diverse cable routes and the large junction box in the center of the intersection are single lines of ducts and manholes away from main traffic lanes.

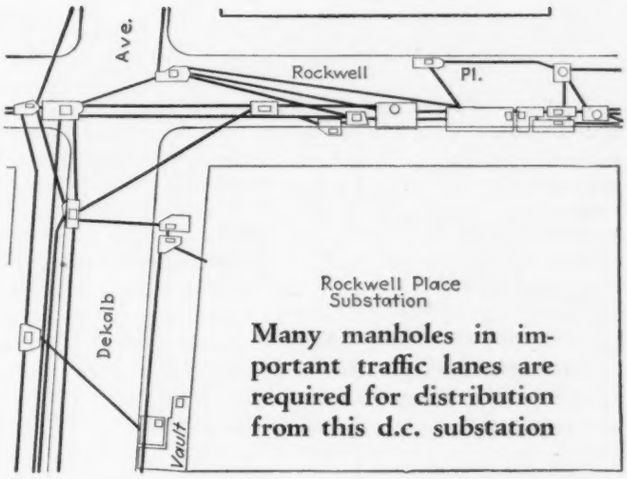
from Network Distribution

lengths being spliced in a coupling box. This system had the advantage of good overload capacity, but each additional service made an opening in the street necessary.

Feeders were connected to mains at intersections through a junction box which was a circular cast-iron device having a cover similar to our present-day manhole and having as many stubs as there were feeders and mains to be connected, usually four to ten. All of the tubes radiated from the box on the same horizontal plane, and the whole assembly in many cases obstructed 30 to 40 per cent of the total intersection area. The burning out of one of these boxes was not an uncommon occurrence and its repair was a great inconvenience to the public as well as an expensive operation.

At many locations tube mains were laid to the obstruction of almost half the width of a street and frequently on both sides of it. When a feeder or a main burned out as a result of overload or from other causes it was frequently necessary to dig it up for a whole block or at several locations before complete repairs were effected.

The contrast between the street space required for this type of distribution and the simplicity of the present method of serving the same locality is shown graphically. The advent of duct lines and manholes for d.c. systems did not help matters greatly, as can be readily seen from the complicated lines and the many manholes about a d.c. substation in another illustration.

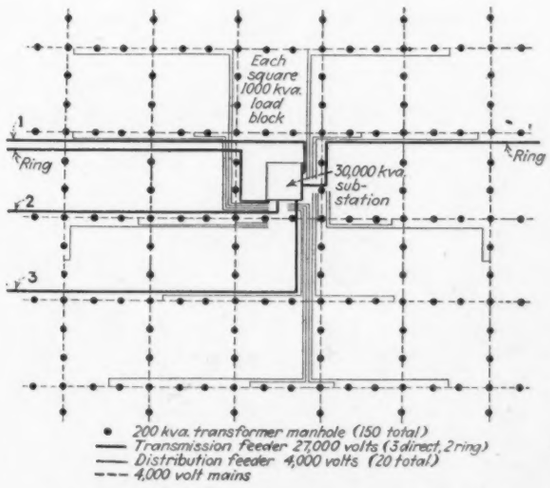


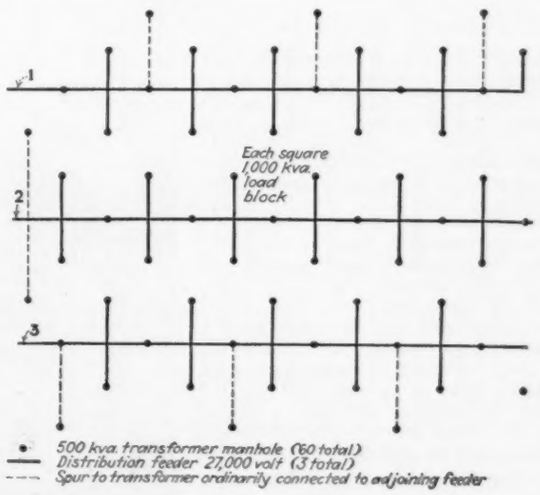
Many manholes in important traffic lanes are required for distribution from this d.c. substation

Radial and network systems compared

The use of a.c. for distribution did not reduce the number of duct lines or manholes to any considerable extent until the network system with a higher voltage supply eliminated the necessity for substations within the distribution area. An assumed 30,000-kva. area is used for illustration. When served with the radial distribution system in use five years ago, a substation is located approximately in the center of the area, with conduit lines and cables leading in from the generating station, and distribution feeders at 4,000 volts outgoing to the areas to be served. The underground network system is supplied with transformer banks of 200 kva. rating. The adjacent illustration shows the same area as it would be served by the present 27,000-volt feeders direct to the service area, with transformers of 500 kva. rating. The number of transformer manholes has been reduced from 150 to 60, clearing many of the streets for traffic.

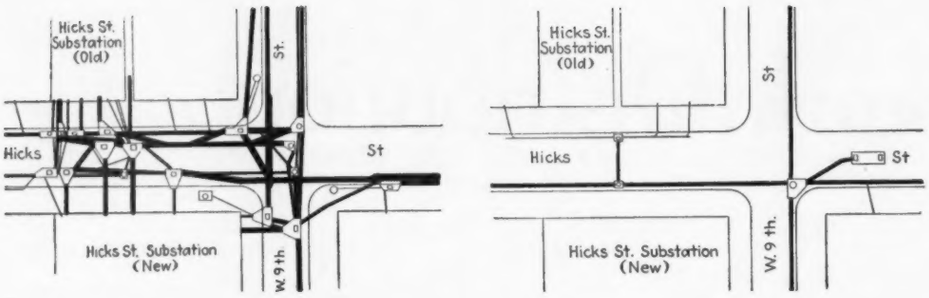
Safety to workers has been greatly increased with the advent of network distribution. Portions of high-tension feeders can now be isolated without interrupting service, and since no work is done on high-voltage lines when alive, the worker is never exposed to more than the secondary voltage of 120/208.




1
2
3
Each square 1,000 kva. load block
500 kva. transformer manhole (60 total)
Distribution feeder 27,000 volt (3 total)
Spur to transformer ordinarily connected to adjoining feeder

Assumed 30,000-kva. area as served five years ago, and as it would be served today

Note simplicity of feeder lines, reduction in the number of manholes, and absence of congestion about the substation.



Duct lines and manholes about an a.c. substation five years ago and present method of serving the same area

The single network duct line provides service across the street by laterals to distribution boxes close to the curb. New customers are served from this box without opening the street paving.

One of the most important features of this system is the elimination of the substation and the duct line congestion near it. In radial distribution, feeders between a generating station and a substation must have not only diversity of route on the street but a set-up at the generating station and substation so that a failure will not imperil continuity of service. Feeders routed out of the substation to the service areas must also have a diversity of route in order that a feeder failure or a manhole burnout will not involve a group of feeders supplying the same general area. In network distribution route diversity from the generating station is still essential, but the intermediate congestion at the substation is eliminated. In addition, where the substation is used, a partial duplication of line is necessary, since the incoming feeder at high voltage must pass through the same area that is served by the lower voltage distribution feeder from the substation. This duplication is eliminated by the network system.

Network simplifies complicated duct lines

The resultant saving in street space about a substation is clearly shown in an accompanying illustration. The first portion shows the accretion of manholes and the complicated duct line arrangement made necessary by the growth of the system and the necessity for providing several feeder routes for safety; the second shows the greatly simplified method which would be used to serve the same locality at present, with greater assurance of service continuity.

At least three feeder lines of diverse routing supply each network area. Reliability of electric supply is assured by tying together the secondaries of the transformers, so that in case one feeder is temporarily out of service, the remaining feeders automatically assume the additional load.

To the municipality, then, network distribution offers the following major advantages:

1. Smaller duct banks and therefore decreased street space per kilowatt transmitted.
2. Fewer line manholes and smaller manhole dimensions.
3. Placing of transformer manholes to insure a minimum of obstruction, both underground and on the surface.
4. Increased safety to workers.
5. Elimination of duct congestion about substations.
6. Increased reliability by networking of secondaries.

The growth of electric service has been paralleled by the growth of street traffic. Not only the supply of electricity, but also the flow of traffic must be as free from interruption as possible. Where the improved practice of the one makes possible an improved situation in the other, the greatest gain is to the municipality.

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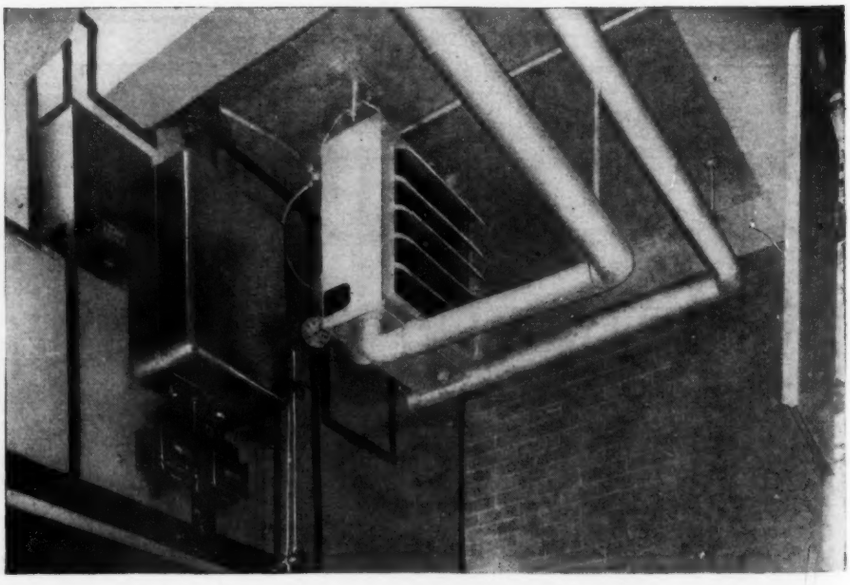
Automatic Off-Peak Heating for Unattended Substation

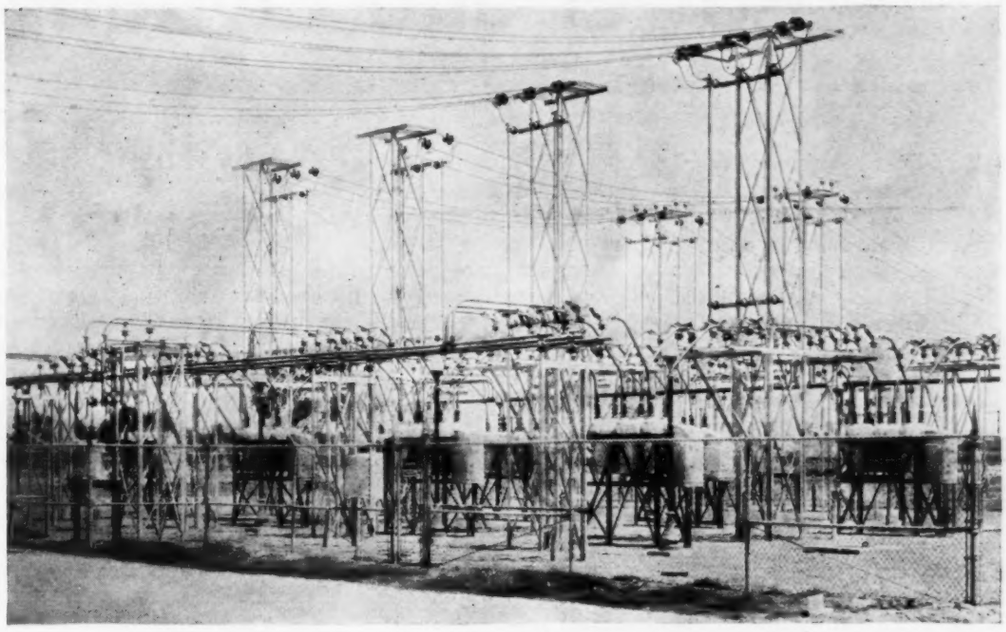
To insure station temperatures offering reasonably uniform conditions for all seasons, and especially to avoid cold-weather difficulties through impaired operation of relays, breakers or other apparatus, the Ohio Power Company has installed full-automatic, off-peak storage heating in its Pleasant Street substation at Ironton, Ohio.

Hot-water radiators backed by fans distribute the electrically generated heat. During off-peak hours electric heat warms storage water to a temperature as high as 250 deg. F. with a pressure of 50 lb. per square inch, and this stored heat is then released through the station system as required. The Hall electric heating system has been installed in a number of stations of the subsidiaries of the American Gas & Electric Company.

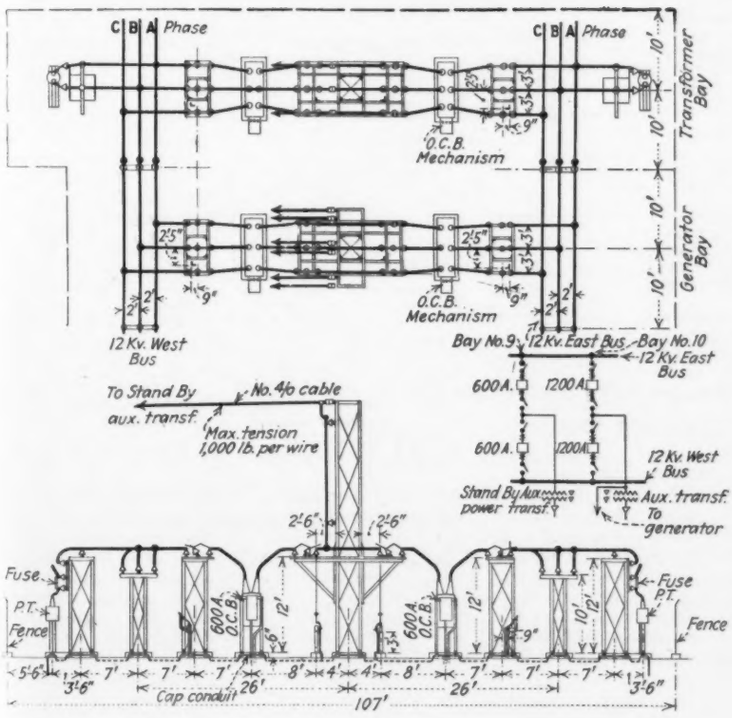


Generators Direct-Connected to "Flat" 12-Kv. Switchyard

AT THE Phoenix (Ariz.) steam plant of the Central Arizona Light & Power Company the 15,000-kw. turbo-generator is connected directly to the outdoor 12-kv. bus structure through 15-kv. oil circuit breakers. The indoor connection consists of two 1,000,000-circ.mil varnished-cambric-insulated, flameproof, braided 15,000-volt cables per phase supported on 15-kv. insulators. The outdoor part of the connection to the outdoor bus consists of two 600,000-circ.mil bare copper cables per phase. Since the generator is tied directly to the outdoor buses without using transformers, it was considered advisable to install a lightning arrester with spillway gaps on the generator leads close to the power-station wall in addition to having lightning arresters with spillway gaps installed on all outgoing feeder circuits.



Service reliability dictated use of 12-kv. flat-type switchyard



Owing to the importance of this station, it was decided to design a "flat type" of switch structure similar to the type usually used for much higher voltages, but to modify the design from the standpoint of space requirements as well as cost in order to make it adaptable for 12-kv. service. This modified design requires only two types of steel towers and two types of steel-supporting posts, as shown in the accompanying figure. The higher tower is designed for line pull-offs, supporting oil-circuit-breaker isolating switches on the line side, or for supporting spillway gaps, potential-transformer fuse mountings and lightning-arrester disconnecting switches for the outgoing 12-kv. lines. The lower tower is designed for mounting oil-circuit-breaker isolating switches on the bus side or fuse mountings for bus potential transformers. A low steel post is used for supporting the 12-kv. buses. The buses and cross-connections are 2-in. and $1\frac{1}{4}$-in. copper tubing.

The outdoor "flat-type" design was not selected from the standpoint of cost, which is probably no less than the cost of a more conventional indoor type, but because this construction was felt to offer a maximum of service reliability, a factor of considerable weight in substation design.

Metering Combined Power and Lighting Loads

By HAROLD W. KING

Sangamo Electric Company, Birmingham, Ala.

WITH the increasing number of installations where the user of three-phase, three-wire, 230-volt secondary power is supplied with either two-wire, 115-volt or three-wire, 115/230-volt lighting from the same open or closed delta transformer bank, the selection and connection of the proper watt-hour meters is one which first requires a careful analysis of the characteristics of the two loads.

Conditions, varying from a large power load with a small lighting load to a large lighting load with a small power load, with or without demand with diversity factor included, defeat the adoption of one uniform metering scheme for all cases.

It is the object in the presentation of this article to illustrate how some of these conditions may be met and to point out the advantages or disadvantages of the various combinations which may be used.

On switchboard installations the standard duplex meter, consisting of one two-element, three-phase, three-wire, 230-volt meter and one two-element, three-phase, three-wire, 115-volt meter, offers a convenient, flexible and accurate method of combining large power and lighting loads which may or may not have like ampere ratings of current transformers in the respective circuits.

If required, either the self-contained demand or contacts to operate an external type demand meter may be embodied in the duplex type polyphase switchboard watt-hour meter register.

The accuracy and flexibility of this method are impor-

(*Continued on page 776*)

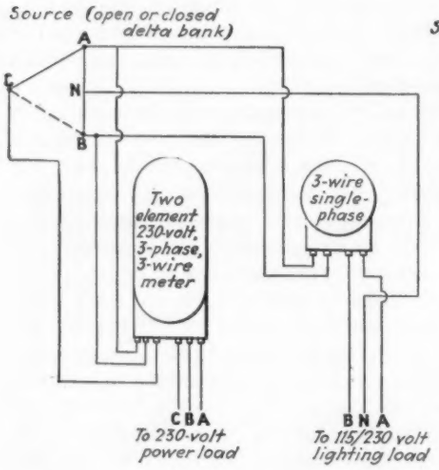
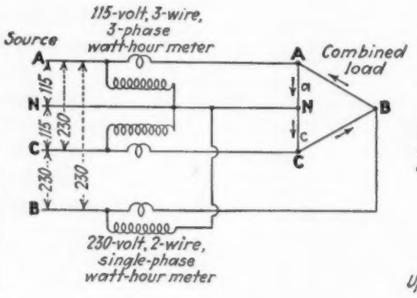
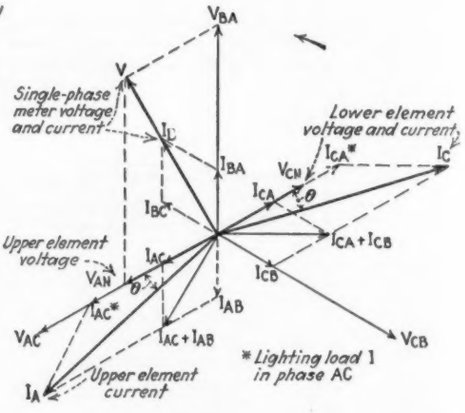


Fig. 1—Two meters for power and light

Fig. 1—Where it is permissible to use two watt-hour meters, when no demand is required, and the maximum loads fall well within the range of self-contained watt-hour meters, the problem is easily solved through the use of one two-element, 230-volt polyphase meter and one three-wire, single-phase meter as illustrated.

This scheme is flexible in that the two meters need not necessarily be of like ampere capacity, but may be selected according to the respective loads to be measured.




Single-phase meter voltage and current
Lower element voltage and current
Upper element voltage
Upper element current
* Lighting load 1 in phase AC

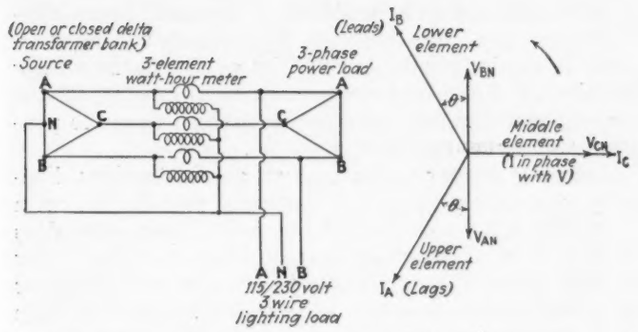
Figs. 2 and 3—Small power and large lighting load

Then, again, if the slight errors in the single-phase meter, which are inherent if and when the two voltages *AN* and *NB* are unbalanced, are objectionable a 115-volt, three-wire, three-phase watt-hour meter may be substituted for the single-phase meter shown.

When either or both of the loads are above the ratings of self-contained meters two two-wire current transformers may be used, with the polyphase meter on the power load and a three-wire current transformer on a suitable single-phase meter, or two two-wire current transformers when a polyphase meter is substituted for the single-phase meter.

Figs. 2 and 3—One large utility has used this method when a high degree of accuracy is desired in instances where the lighting load is large and the power load is small. While the connection diagram is shown for self-contained meters, the method is equally applicable to installations requiring current transformers, in which case the capacity of the current transformer connected to the single-phase meter need not be of the same capacity as the pair connected to the polyphase meter. This method is extremely flexible in that no special transformers or meters are required.

Any doubt relative to the accuracy of this method under varying conditions of load, voltage and power factor is dispelled through a study of the vector diagram, Fig. 3, which for convenience and clarity has been drawn for balanced load and voltage at unity power factor.



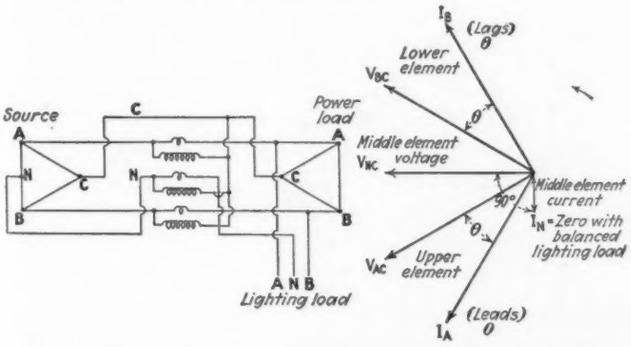
Figs. 4 and 5—Demand indication requires combined metering

Where the power and lighting loads must be combined on one meter for measurement of kilowatt-hours and for maximum demand wherein the diversity factor is included the selection of the power instrument involves the avoidance of many aggravating obstacles.

One method employed by some utilities when the power and lighting loads are within reasonable limits requires one three-element watt-hour meter with its three current coils connected in the three respective phase wires.

The vector diagram for this connection is also shown. For simplicity it has been constructed for balanced load and voltage at unity power factor.

Using a standard three-element, 230-volt, polyphase watt-hour meter an analysis of the vector diagram discloses the fact that the voltage impressed upon the upper and the lower potential coils is 115 volts, whereas the voltage impressed upon the middle potential coil is approximately 200 volts. It is obvious that potential coils of 115-volt rating and current coils with the required number of turns might readily be supplied for the upper and the lower elements in order to secure better operating conditions, with the result that the meter immediately becomes a more or less special instrument. Where sentiment or regulations prevent the use of special meters there is the alternative of using the standard meter and making all calibrations at the actual voltages impressed upon the respective coils.

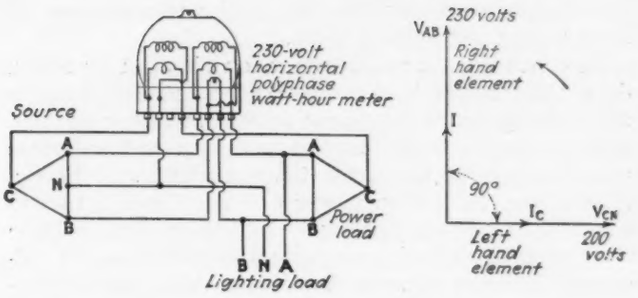


Figs. 6 and 7—Three-element meter, secondary neutral ungrounded

On ungrounded secondary systems the above connection might be employed as a means of avoiding the possible objections to the connection in Fig. 4.

It will be noted from the vector diagram, Fig. 7, which for convenience has been drawn for balanced load and voltage at unity power factor, that the middle potential element has but approximately 200 volts impressed upon it. This is of little consequence, for since its current is displaced 90 deg. from its voltage, it is inactive on balanced or unbalanced load until the power factor of the lighting load drops below unity.

The chief objection to this connection is that with the middle tap of the lighting circuit grounded at the transformer bank, as it is in the majority of installations, any current taken from phase wire *C* to the ground is not registered on the meter.



Figs. 8 and 9—Horizontal polyphase meter with differential gear train

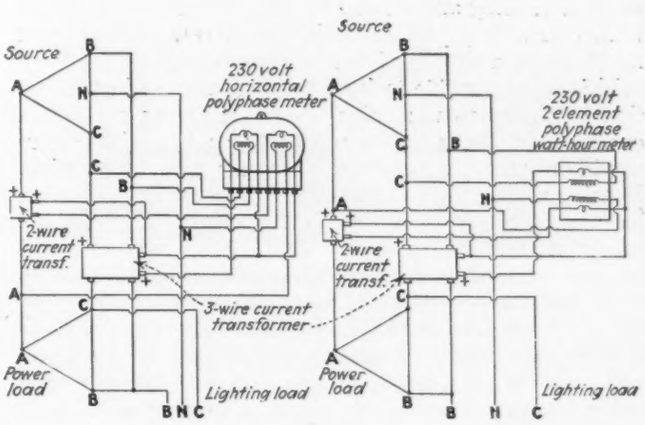
One convenient means of utilizing a two-element, self-contained watt-hour meter, with or without maximum demand features, with which combined power and lighting loads not too widely separated in ampere ratings may be measured, has been an adaptation of the standard horizontal polyphase watt-hour meter.

It will be observed from the connection diagram, Fig. 8, that a two-wire meter element is used on the left and a three-wire meter element on the right. The consumption in kilowatt-hours registered through the differential train is the algebraic sum of the readings of the two elements.

This adaptation may also be applied to a polyphase meter of the vertical model, wherein the three-wire element may be used as either the upper or the lower element.

The slight error in the three-wire element in either the horizontal or the vertical model, which is only present if and when the voltages AN and NB are unbalanced, is not objectionable, as it is no greater than the inherent error in all three-wire, single-phase meters now in universal use.

Reference to the vector diagram, Fig. 9, drawn for clarity with balanced load and voltage at unity power factor, indicates that the voltages impressed upon the left and right potential coils are approximately 200 volts and 230 volts respectively.



Figs. 10 and 11—Standard polyphase meter with three-wire current transformer

Where the ratings of the power and lighting loads are balanced within reasonable limits the use of either a standard two-element horizontal or a vertical polyphase watt-hour meter connected to one two-wire and one three-wire current transformer of the same ampere capacity, as illustrated in Figs. 10 and 11, respectively, has been found very satisfactory.

The vector for these connections is identical with the one in the preceding case, Fig. 9.

tant factors to consider in the precise measurement of large power and lighting loads.

In conclusion, it is important, on all open or closed delta transformer banks where a grounded mid-tap is taken from one of the power transformers for lighting, that no auto-transformers are used by any three-phase power customers fed from the same bank. Where a three-phase, three-wire power customer uses a two to one transformer for lighting it should be a standard type with secondary winding properly insulated from the primary. The use of auto-transformers can and may introduce errors of varying magnitude on grounded neutral systems.

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What Sales Manager Can Do to Reduce Distribution Costs

Loading existing facilities and greater initial load on extensions will reduce investment per customer

By S. BINGHAM HOOD
Development and Research Engineer, San Leandro, Calif.

UNQUESTIONABLY the economic advances in design and application in generation and transmission have lowered the cost of production, but cutting production costs that a few years ago were up between 1½ and 2 cents per kilowatt-hour down to present levels that run between one-third and two-thirds of a cent, and in a few exceptional cases lower than that, has not appreciably lowered the price to the average consumer. Cutting the energy cost at the bus in half is an achievement our engineers may well be proud of, but to the average consumer, using around 600 kw.-hr. per year, all it means is that he now pays 6 cents for energy that used to cost him 7 cents, a saving of but 14 per cent.

If it were possible to keep up this increase in production efficiency to the point where busbar cost is again cut in half, the average consumer as he exists today would only profit by about a 7 per cent greater reduction. Bearing these things in mind, it is evident that we must look further than generation and transmission if we are to get electric service down to the point where it will be used to perform every household task. Obviously there are three avenues of approach to the problem of reducing unit distribution costs. The first is to sell more service to existing consumers to increase consumption and improve load factor, thereby reducing kilowatt-hour delivery costs. Second, to secure a greater initial load on extensions by inducing customers to install a range, water heater, refrigerator and other household appliances at the time the extension is made. This will prevent the increases in unit distribution costs taking place on most systems as a result of adding lightly loaded extensions. Third, to reduce investment in the distribution system itself by changes in practice. Only the first two of these possibilities will be discussed in this article.

It is patent that increasing the load on existing facilities is a problem for the sales department. Fortunately our sales people seem to be waking up and some progress is being made on the problem of complete home electrification. There is, however, ample room for improvement in the load-building activities of practically all our utilities. Inducement rates, concentrated sales effort and some plan for making it easier for the customer to purchase appliances are what is needed.

Securing greater initial load on new extensions, likewise, is a sales problem. Commercial men do not seem to realize what a new customer, with lights only, does to the cost of distribution per kilowatt. Take, for example, a typical "missionary" extension of three spans to serve the first house in a new block. Here the pole and secondary cost would be around $60 per span, or $180 for that one customer. If this customer were left to himself, as most order-taker salesmen do in such new districts, his use would be for lights and miscellaneous appliances, giving a demand when integrated of about one-fourth kilowatt. In that case his cost per kilowatt of demand for pole and secondary alone would be $720. If we add to this substation, primary and transformer costs, for his actual demand only, that would be $12.50 more, or a total investment of about $732. With annual carrying charges of around $88 per annum to be met from a gross return from sale of energy of about $25, it does not take many such customers, with a loss of $63 each exclusive of actual energy cost, to make the books look wrong.

Had the sales department been on the job it would have induced this customer to install a range, water heater and refrigerator. Such an increase in load would have resulted in an integrated demand of about one kilowatt. The investment cost per kilowatt would have been reduced from $732 to $230, a 70 per cent reduction made solely as the result of intensive sales effort. The gross revenue from this load under a reasonable form of promotional rate would have been at least $100 per annum. The actual cost of serving this load with energy costing half a cent at the bus and three-quarters of a cent at the consumer's meter, plus fixed charges at 12 per cent per anum, would have been $82. This would leave a surplus of $18 to help offset the loss on other customers who were permitted to "go on the line over the counter."

The accompanying table shows very clearly the advan-

Effect of Load Building on Distribution Costs

Distribution of Cost per Kilowatt of Integrated Demand		
No. of Customers	Non-Intensive Load	Intensive Load
1	$1,490	$410
2	770	230
3	530	170
4	410	140
5	338	122
6	290	110
7	256	101
8	230	95
9	210	90
10	194	86
11	182	83
12	170	80
13	162	78
14	154	76
15	146	74
16	140	73
17	134	71
18	130	70
19	126	69
20	122	68

tages which accrue from increase in customer density as well as from load density obtained as the result of intensive sales effort.

Naturally no commercial department can be criticised for inability to sell energy to vacant lots. Neither can it do much to force building on such lots, and certainly cannot refuse to serve the pioneer residents in such new locations. What it can do, however, and must do if it wants distribution system unit costs to stop skyrocketing, is get out and put some intensive selling effort back of its product.

The foregoing discussion has been given purely to show how distribution costs are affected by load development as entirely separate from distribution engineering. The accompanying tabulation applies to average domestic business and is based on a one-block extension of six spans with twenty consumers as a maximum. Pole and secondary cost $60 per span, distribution transformers $10 per kilowatt, primary lines $15 per kilowatt and substations $25 per kilowatt.

Non-intensive load is "over-the-counter" business for lights and miscellaneous appliances.

Intensive load is for full domestic service obtained through intensive sales effort.

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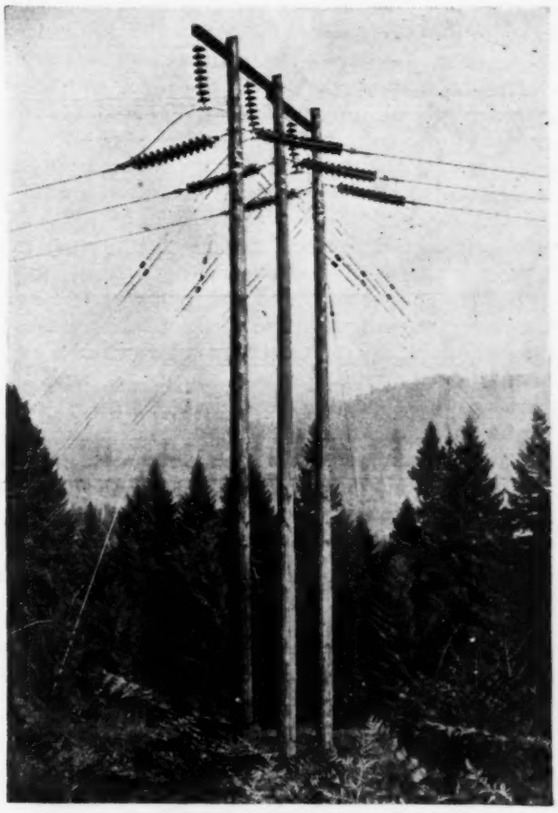
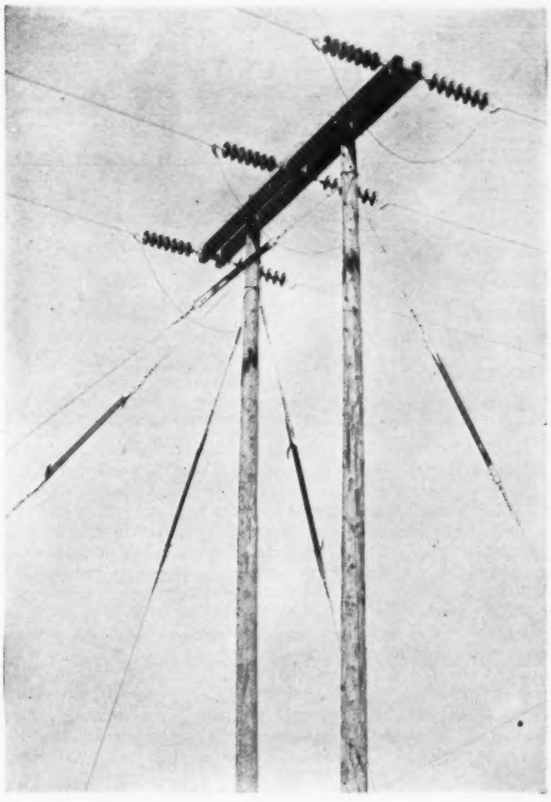
Increasing Impulse Flashover Values

TWO types of guyed structures for 110-kv. transmission lines designed to increase the impulse flashover value of wood structures are shown in the accompanying illustrations. The left view is a two-pole dead-end structure in the Beverly-Rock Island line of the Puget Sound Power & Light Company, while the one on the right is a three-pole structure in the Vancouver-Ariel line of the Northwestern Electric Company.

On the Rock Island line creosoted fir insulating strips 9 ft. long are placed in all ground guys in the manner shown. Arcing horns at each end of the wood strips protect them from possible lightning damage. Line insulation consists of six units in suspension strings and seven units in dead-ends. Conductor spacing is 11 ft. 6 in.

On the Ariel line the so-called "balanced insulation" method was used. Twelve insulator units at 143-kv. impulse flashover value each, plus a foot of the pole (between point of insulator attachment and guy wire) at 170 kv., provides a total flashover value of 1,886 kv., which is calculated to be about equal to the average of 2,100 kv. arc-over insulation of the 5 ft. minimum air spacing between conductor and nearest guy wire. In this type of construction all possible hardware is omitted. Eight insulator units are used in suspension strings and twelve in dead-ends and on guyed structures. Conductor spacing is 11 ft.





Two methods of increasing impulse strength

Left—Nine-foot wood strain insulators preserve impulse insulating value of guyed wood structures. Right—Impulse insulating value of insulator string, plus 1 ft. of pole, is balanced against arc-over voltage of 5-ft. air gap to nearest guy as lightning protection on guyed wood structures.

Drumm Storage Battery Charges at 600-Amp. Rate

HEAVY current discharge during periods of acceleration and a charging rate considerably in excess of that of any batteries now on the market are the claims made for a low-resistance alkaline storage battery invented by J. J. Drumm of University College, Dublin, and recently tested on the Great Southern Railway of Ireland, according to an article in *Engineering*.

The battery, which has 77 cells, each 12 x 18 x 10 in., and weighs 6,000 lb., was used to supply power to a 13-ton railway coach having two 110-volt, 35-hp. motors capable of sustaining an overload of 100 per cent for ten minutes and of 200 per cent for a short period. During a day's run the coach covered a distance of 173 miles in a series of short journeys. The main charge was put into the battery at a slow rate during the night and boosting charges at 200 amp. for ten minutes, 400 amp. for twenty minutes and 600 amp. for ten minutes were supplied at intervals during the day, the average voltage on charge being 152 volts. During the day's operation a total output of 193 kw.-hr. at an average voltage of 122 was obtained. During acceleration periods the normal maximum current was about 800 amp. with a pressure drop of 20 volts. The maximum speed obtained was 48.5 m.p.h., with an average running speed of 29 m.p.h. for the day. At the end of the day the battery registered 122 volts and the temperature of the cells was 30 deg. C., with an air temperature of 13 deg. C.

During a subsequent test run the maximum current during acceleration was about 1,000 amp. and the power developed 110 kw. The maximum speed attained was 50 m.p.h., the average speed for the day's run being 40 m.p.h. The maximum acceleration rates recorded were 1.24 m.p.h.p.s. up to 30 miles per hour on the level and 0.6 m.p.h.p.s. up to 30 miles per hour on an up-grade of 1 per cent. The energy consumption of the coach was about 85 watt-hours per ton-mile, which is about twice what it would be for a specially built train. Smooth operation was obtained during the tests.

50 per cent higher voltage obtained

The Drumm battery has an efficiency of 75 per cent under practical conditions of operation, a current efficiency of 95 per cent, and it has 50 per cent higher voltage than existing alkaline batteries, according to a statement by the Minister for Industry and Commerce published in the *Irish Independent*. This statement also stipulated that the battery is of more simple construction than existing batteries and should be less expensive to manufacture; that it is so constructed that damage from vibration cannot result, and that in respect to retention of charge, it is superior to existing batteries of a similar type.

The cells of the battery are composed of eight negative and nine positive plates. The positive plates are of the standard nickel-hydrate type and the negative plates, the specifications of which are secret, appear to be a common thin sheet of metallic gauze composed of zinc and aluminum. The electrolyte is a solution of caustic potash.

As to the life of the battery, the positive plates are guaranteed to last for ten years, while the secret negative plates are said by Dr. Drumm to be indestructible, according to the *Electrical Review*. The electrolyte must be renewed or decarbonated once a year to insure good battery performance.

The watt-hours per pound of battery are given as 8 to 10, although approximately three times that output may be obtained by giving the battery boosting charges during the day's run.

In regard to the importance of this new invention R. N. Tweedy writes the following in the *Electrical Review*: "At this stage I think we should be justified in assessing the value of the Drumm battery relatively to the value of the lead and other batteries to be of the same order as the value of the metal-filament gas-filled lamp relatively to the carbon-filament vacuum lamp. That it will cause anything approaching a revolution in traction from the point of view of the general public I do not believe, nor do I think the inventor and his associates would suggest it."

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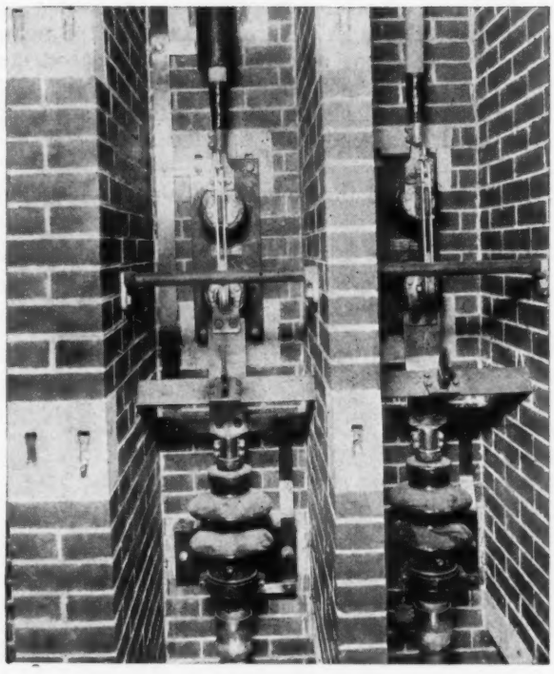
To Prevent Misgrounding



To facilitate grounding of 13,800-volt feeders at the plant of the Lynn (Mass.) Gas & Electric Company, double-throw disconnecting switches are provided by which each phase of the underground cable can be cut off from the station bus, left open or connected to a ground bus running continuously through the switch cells as illustrated. Permanent ground clips are bolted to the bus in line with the switch jaws, but to prevent premature grounding each cell is provided with two slotted castings bolted into the barrier wall and forming sockets for a 1¼-in. diameter micarta bar which must be removed before the grounding switch can be thrown downward to the ground bus. The Stone & Webster Engineering Corporation, Boston, designed these facilities in connection with a plant extension job.

Human Products for Technical Industries

Industrial executives and educators discuss relations of engineering colleges and industry

ABOUT ten thousand engineering graduates are supplied to industry each year. These afford the raw material to man the technical industries of the country. It is of some concern, therefore, to industrial leaders and to college authorities to see to it that these technical men are properly used in industry.

Last week at Lehigh University prominent educators and industrialists discussed their common problem—the relations between the schools and industry. This is an old topic, but it is of fundamental importance.

Strange to say, opinion has crystallized and become almost unanimous as regards what industry expects of the schools. F. A. Merrick, Matthew S. Sloan, Alfred R. Glancy, Bancroft Gherardi and L. W. Baldwin, as representatives of large divisions in American industry, agreed upon certain fundamentals for schools to use. In essence they said that schools should select incoming students as intelligently as possible and then train them for four years only by teaching them basic science, mathematics and economics in such a way as to fix principles and develop proper habits of thought and work. They stressed the necessity for educators to stick to fundamental principles and urged them to eliminate the specialized or practical courses. They expect to teach practice and develop specialization after the young graduates have entered industry.

Industrial leaders' requirements of educational institutions

Bancroft Gherardi, vice-president and chief engineer of the American Telephone & Telegraph Company, said his company looked for young technical men who could "recognize the problems with which they are confronted, study the problems, determine the appropriate action, and then take such action in the right way. There must be imagination, intelligence, judgment, intellectual honesty and high aims. The important thing in education is that the engineering student should have discipline in the methods of solving engineering problems and a general foundation in mathematics, physics and materials."

F. A. Merrick expressed a similar sentiment. "Industry does not expect men from the schools ready qualified to solve every problem concerned in the manufacture of one item of electrical equipment, much less all of them," he said. "Industry does expect, however, a group of men so selected and so trained in fundamentals and in analysis that they can develop into the doers of everything needful for the solving of each problem in the whole range of requirements."

M. S. Sloan, president of the New York Edison Company, said: "What we look for is men who have attained a good academic standing in their classes, but not necessarily the highest. We expect them to know their books and tables, but we expect them to know a good deal more —to know, for example, that the books and classroom work are simply a basis, a foundation, and that some of what they have been taught is out of date already or wrong. We expect them to know how to reason, how to think. We expect them to have curious minds, inquiring minds, eager to acquire information, active to associate it with other information, able to digest it and put it to use. We want them to have initiative and character. We want them to have intellectual and moral courage as well as physical. We want them to have a personality that will enable them to deal successfully with a trench digger or the president of the companies. We want them, having information and ideas, to be able to present them clearly and persuasively, orally or in writing."

In general the industrial executives were well satisfied with the college graduates. They stressed the advantage of broad training as well as technical training. They stressed the need for inculcation of a democratic and humble attitude in the students when first out of college —a realization that a living must be earned, not donated because of educational advantages. Very positive belief was expressed that industry is becoming more technical and will need technically trained men in greater degree, but that cultural elements and influences must be introduced into the training program in order to produce the best type of recruits.

Alfred R. Glancy, president of the Oakland Motor Car Company, expressed this general opinion in the following words: "The automobile business is sympathetic and eager for the college-trained man thoroughly grounded in the fundamentals of science. We want him tolerant and co-operative, with as much general culture

as you can give him, and to that man we offer more opportunities and greater opportunities than have ever been offered before."

Educators not satisfied with co-operation

But the educators did not express the same degree of satisfaction with the support and co-operation they are receiving from industry. They stated that industry could do more to help train and place the college recruit after graduation, and they commended the thorough methods developed by some industrial organizations for following through with the training started in college. The most significant of their utterances was the challenge to industry to support the schools in their endeavor to get and retain competent faculties and to prosecute adequate research projects. This thesis was splendidly developed by Prof. D. C. Jackson of the Massachusetts Institute of Technology.

Professor Jackson said: "The engineering schools expect industry to recognize the duty of the schools (pertaining to them as educational institutions) of independence in thought, in subjects and methods of research and in opinions. In return the faculties should recognize a duty to refrain from spreading inadequately founded opinions and from dogmatizing controversial fields. The engineering schools expect industry to recognize the importance of independent creative scientific research as part of the life of the faculties and students and to support it with contributions of money and counsel made to those schools that are adequately manned and equipped, to the end that additional knowledge may be disclosed out of which industry may forge new applications; and also to recognize the importance of such research as a pedagogical instrument in those schools that are manned and equipped to carry it on properly.

"Special investigations for an industry that may be carried out in a school, with free relation to students and with the understanding that the results may be published, may be mutually useful to school and industry even if a staff adequate for consecutive work on independent research is not available. Having routine tests made and having special confidential researches carried on in the engineering school laboratories is a privilege that industry may claim and expect to be allowed, but this absorbs the intellectual power of members of the faculty and the time of equipment without recompense through student relations or publication of results; and this should be compensated for by money contributions which may be applied to independent research. The engineering schools expect large industrial establishments to pay more attention, in their own interest, to the articulation of recent graduates into the work for which they are employed."

In the long run industry will suffer if it takes away from the school faculties the ablest men and denies to the colleges research projects so essential to the pedagogical process. In some way able men should be able to gain remuneration commensurate with their talents and yet remain on college faculties. Industry now drains the ablest men away from the schools and is supporting its own researches without recognizing the need for the atmosphere and technique of research as a necessary part of education. In the long run industry will suffer unless these conditions are rectified.

Many tangible suggestions were made by educators whereby the relations of industry to the college could be improved. Advice and counsel, co-operation in research, co-operation in teaching and co-operation in training after graduation were some of the tangible suggestions.

As a result of the meeting and discussions it was very evident that progress is being made. The products of the schools are improving; the co-operation between schools and industry is better; industry is doing more to train its recruits, and educators are improving their methods. The striking need of the colleges is for better staffs, and that of some industries at least is better methods for continuing training of college students after graduation.

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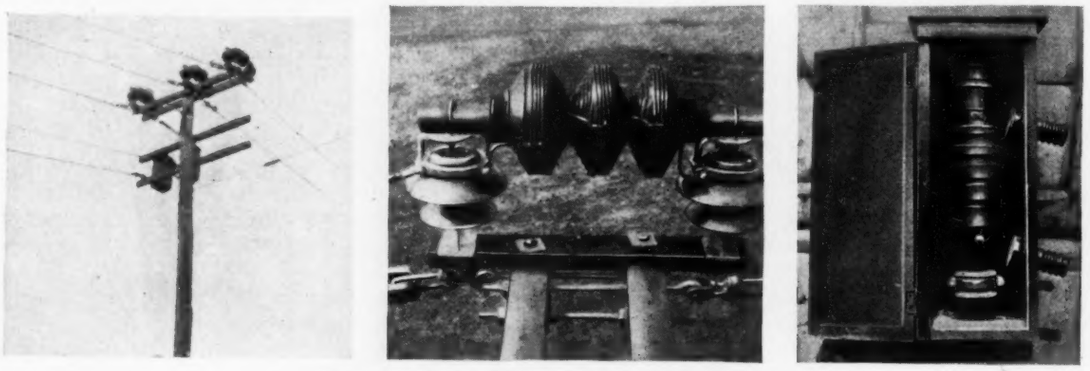
Choke Coils Eliminate Radio Interference

By A. S. WARNER

Transmission and Distribution Department, Metropolitan Edison Company, Reading, Pa.

RADIO interference in a thickly populated residential section in the immediate vicinity of a double-circuit 66-kv. pin-type transmission line of the Metropolitan Edison Company, Reading, Pa., is being successfully eliminated by means of choke coils in the circuits where they enter the residential section.

Before the choke coils were installed the disturbances set up by the 66-kv. line were communicated to radio receiving sets throughout the neighborhood by the dis-



Choke coils block radio disturbances

A few feet below the crossarms is the telephone cable with insulating joints inserted. The choke coil for the 23,000-volt line is in the center and that for the series street-lighting circuit is at the right.

tribution circuits. On the same pole line as the 66-kv. conductors are a three-phase, 2,300-volt distribution circuit and two conductors of a street-lighting circuit. These carried the disturbances. The 2,300-volt line is in joint construction with telephone circuits, which also carried the disturbances into the residential district, where they spoiled radio reception.

On the border of the residential district referred to the choking system was installed on a pole. The continuity of the telephone cable sheath at that point was broken by inserting an insulating joint. On each side of this joint strain insulators were inserted in the cable messenger. In the two conductors of the street-lighting circuit standard 500-turn, banked-section, 4-amp. magnetite-arc circuit "chokes" were installed. These coils were mounted in a wooden box similar to a fuse cut-out box with lead-in bushings.

The design of the coils for use in the 2,300-volt conductors presented some difficulty in that the high carrying capacity necessitated large copper wires, the distributed capacity of which counteracts to a great extent the effect of the inductance.

The specifications for the 2,300-volt choke coil are as follows:

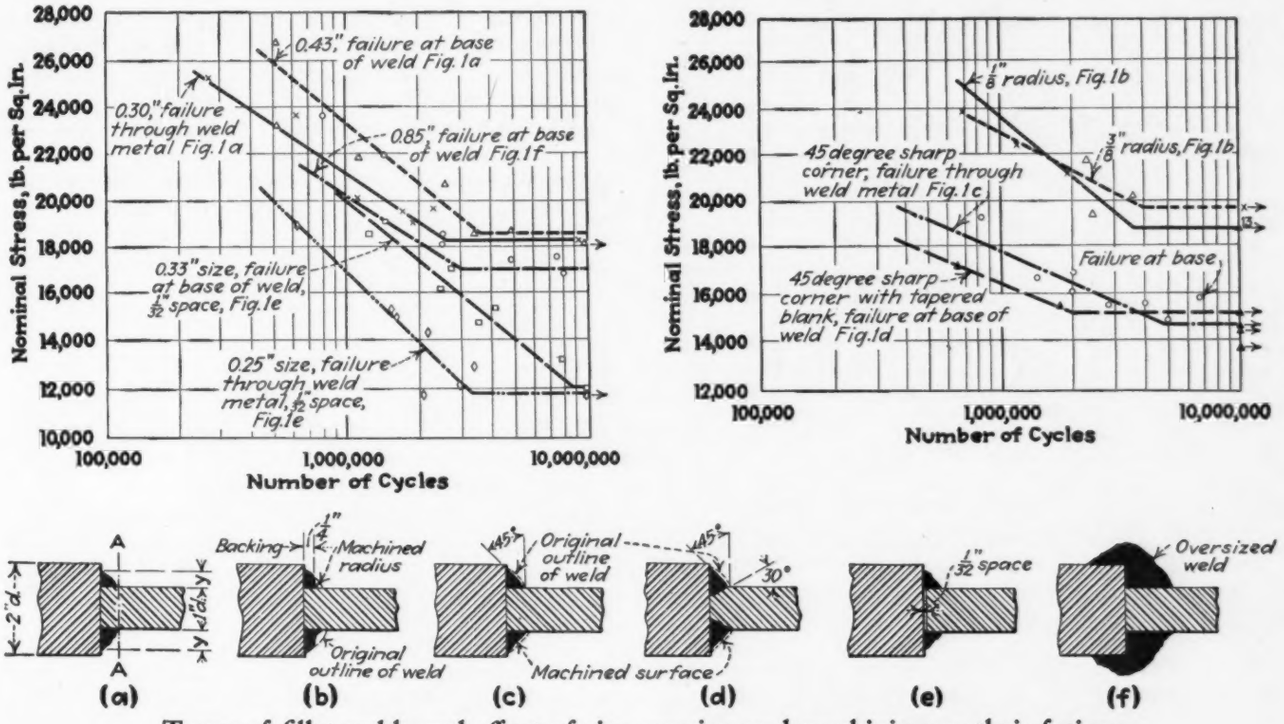
No. 6 weatherproof copper of 300 turns total in three banks; over-all length, 14½ in.; maximum diameter, 10½ in.; wound on a fiber tube of 3⅛ in. inside diameter and 3¾ in. outside diameter. A fiber rod through the fiber tube is attached to the insulator head clamps by means of a "U" bolt. Standard 35-kv. insulators are used and are mounted on a 2-in.x4-in. wooden base. On 60 cycles the coil has a resistance of 0.213 ohm, a reactance of 1.79 ohms and an impedance of 1.8 ohms. On a three-phase, 2,300-volt, 100-kva. load of 80 per cent power factor the voltage drop through the coil is 2.26 per cent.

The intensity of the radio disturbance is reduced 95 per cent in the built-up section by the choke-coil installation.

Fatigue Strength of Fillet Welds*

INCREASING use of electric welding in structures subjected to repeated stress has caused the Westinghouse research laboratory to carry out a series of investigations on the fundamental properties of welded joints in fatigue. Results available to date cover effects pertaining to size of weld, machining and spacing.

From the tests it appears that if the size of the weld (dimension *y* in the figure) is about 0.3 in. or less failure occurs through the weld metal starting on the inside.

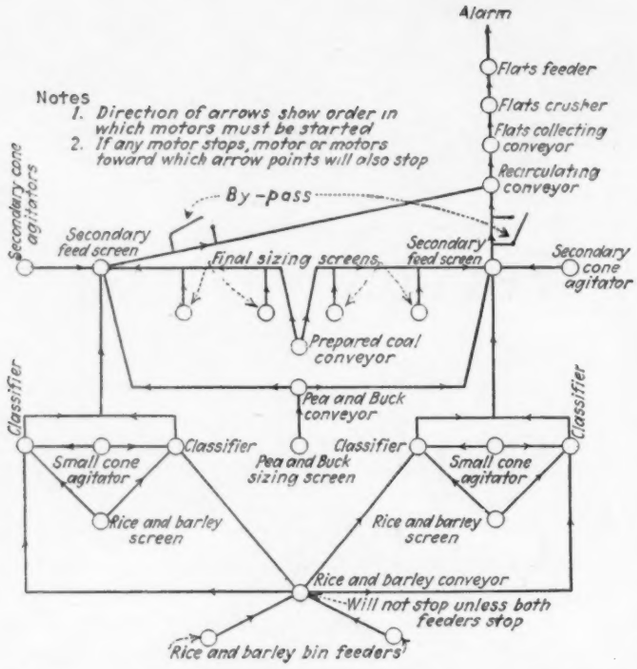


Types of fillet welds and effect of size, spacing and machining on their fatigue

For smaller sizes a reduction in strength would obviously occur. For sizes greater than 0.3 in. failure occurs at the base (section *A-A* in the figure) through the parent metal, with the strength remaining substantially the same except for comparatively large welds, where a reduction of strength is observed. This reduction is apparently a real effect, since similar results have been obtained with oversized butt welds, though the reason is not obvious.

A fillet weld is not appreciably strengthened by a machined radius, and its strength is considerably reduced by a machined sharp corner. It had been anticipated that a strengthening effect would be produced by replacing the ragged sharp corner with a machined radius and thereby reducing stress concentration, but the results did not bear this out. Spacing causes a considerable reduction of strength. This is undoubtedly partially due to the reduction of section modulus.

**Abstract of paper, "Fatigue Tests of Fillet Welds," by R. E. Peterson and C. H. Jennings, presented at a recent meeting of the American Society for Testing Materials.*



Scheme of interlocking of motors to prevent piling up of coal in case of stoppage of machinery

Individual Drives, I

THE extensive modernization program now being carried forward by the Philadelphia & Reading Coal & Iron Company in the great Reading anthracite field in eastern Pennsylvania illustrates to a remarkable degree the vital importance of electricity in economical coal preparation. About two years ago the Stone and Webster Engineering Corporation was engaged by the company to study the problems of coal transportation and preparation for market in this region. The result was a plan for the increased use of electricity in the mines and the construction of a number of great electrically operated central breakers in which "run-of-mine" coal would be cleaned, sized and shaped (selected) for market.

The first unit has been constructed at Locust Summit, near Mount Carmel, Pa. It is the world's largest anthracite breaker. It prepares for market the Reading anthracite from five mines and two surface strippings in an area of 10 square miles. Tributary to the central breaker are five cleaner plants located near the mine mouths. The electrical installations give this group first rank as an anthracite preparation assembly from the standpoints of intensive production, operating economy and reliability of service. These plants are pioneer instances of the complete use of the individual motor drive throughout for this class of work. They employ standardized control in unique assembly to insure high-speed machinery operation and quick sequence starting and stopping functions, and utilize automatic control in both major and auxiliary applications to an extent hitherto unprecedented in anthracite preparation.

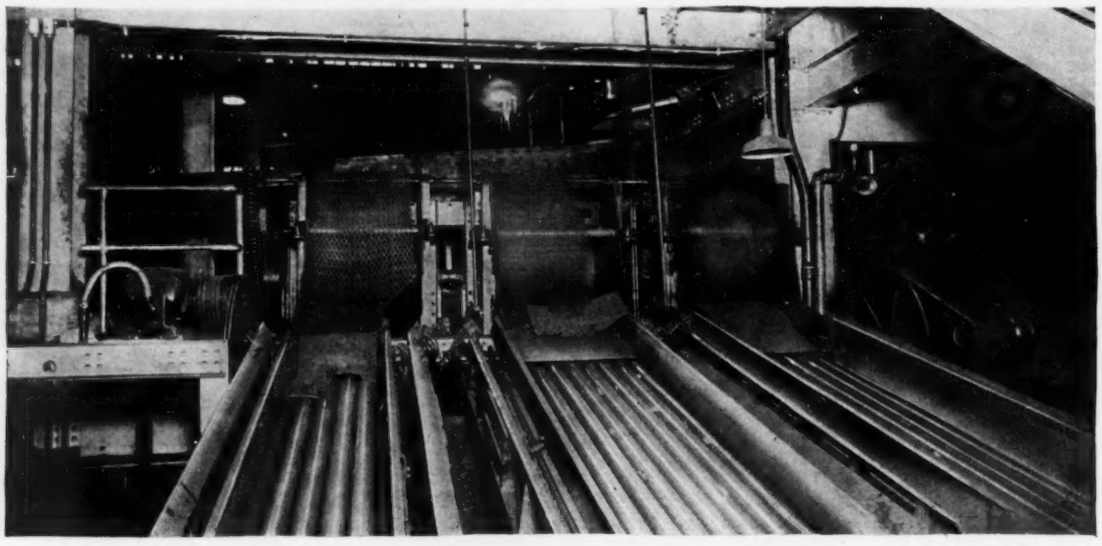
Outline of preparation process

Anthracite preparation starts with the delivery of run-of-mine coal to the cleaner plant and ends with the delivery of commercial sizes of clean, screened and washed coal to railroad cars for shipment to market.

From the electrical viewpoint the power applications are admirable for the induction motor, since the machinery runs at constant speed, with the exception of the points where the coal enters the plant at the feeders.

For the five cleaners and the central breaker plant in this group a total of approximately 340 electric motors, aggregating 7,000 hp. in combined rating, is required.

The value of continuous output in so large a central



Chain feeder and deflatter drive units

Interlocks and Automatic Control

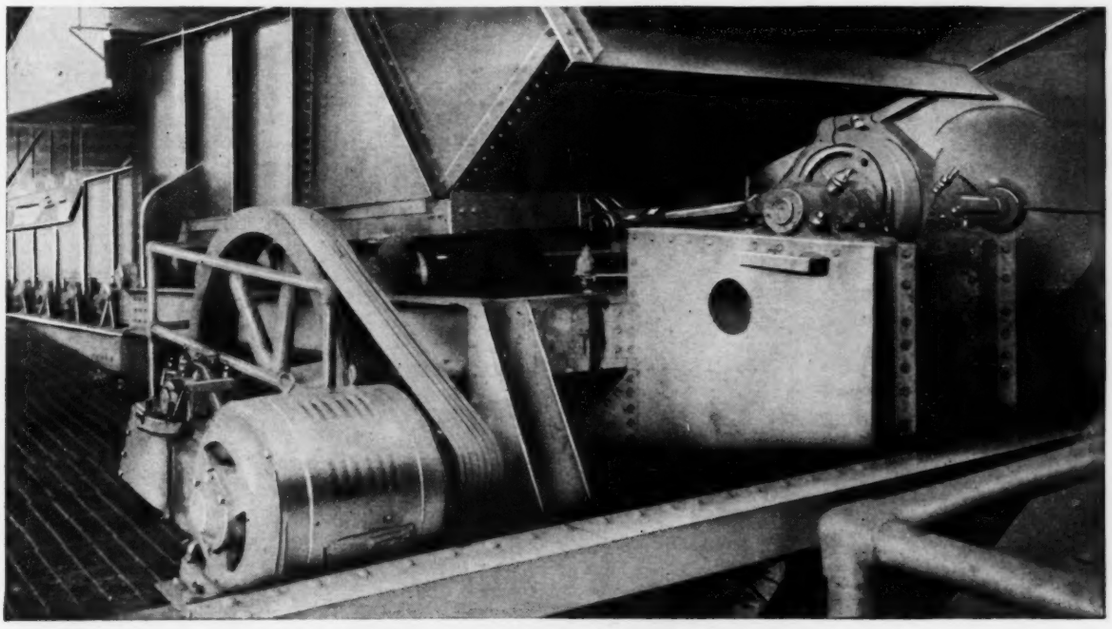
Features of Largest Electrified Coal Breaker

plant as the Locust Summit breaker (present capacity, 12,500 tons in sixteen hours) demands the use of a reliable and flexible distribution system for power and lighting. Two 4,000-amp., 460-volt, three-phase feeders deliver energy from the transformers to the breaker, a distance of about 350 ft. Each feeder consists of eighteen single-conductor cables, six per phase, arranged in six 4-in. iron conduits. The cables are of 800,000 circ.mil, varnished, cambric-insulated. The reactance of the circuit with this arrangement of cable is materially less and the division of current among the cables much more uniform than with the conventional three-phase arrangement. The two duplicate transformers and feeders provide about 75 per cent reserve capacity.

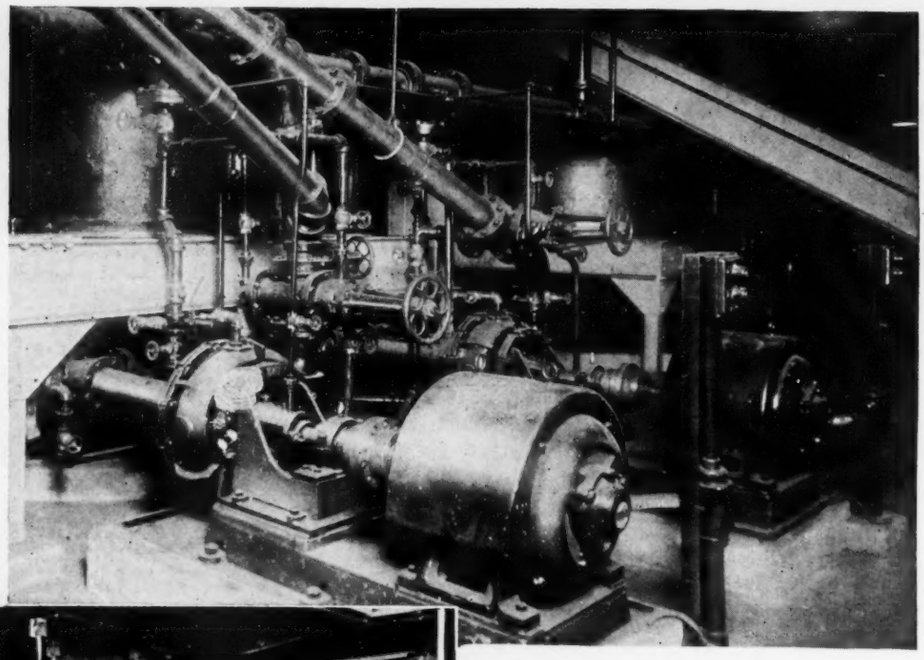
The breaker is arranged with centralized supply system for raw coal, discharge system for refuse and pumping system for process water, but the process machinery is arranged in two symmetrical halves, each a complete and independent unit. The main switchboard in the breaker is sectionalized at the center and each half serves the corresponding half of the breaker. Two circuits, one from each half of the board, feeding motors for the centralized raw coal, refuse and water systems, are equipped with automatic throw-over switches, so that if one-half of the bus should be de-energized, both circuits would be automatically connected with the energized half of the bus. In case of failure of one of the transformers or main feeders the remaining transformer and feeder would carry the entire breaker load for a limited time. Either half of the breaker, together with the raw coal, refuse and water systems, may be run indefinitely if required on one transformer and feeder.

This subdivision of the distribution system provides for flexible and reliable operation, and with the control system adopted enables the breaker to be run economically through a range of loading which would be out of the question in less modern establishments.

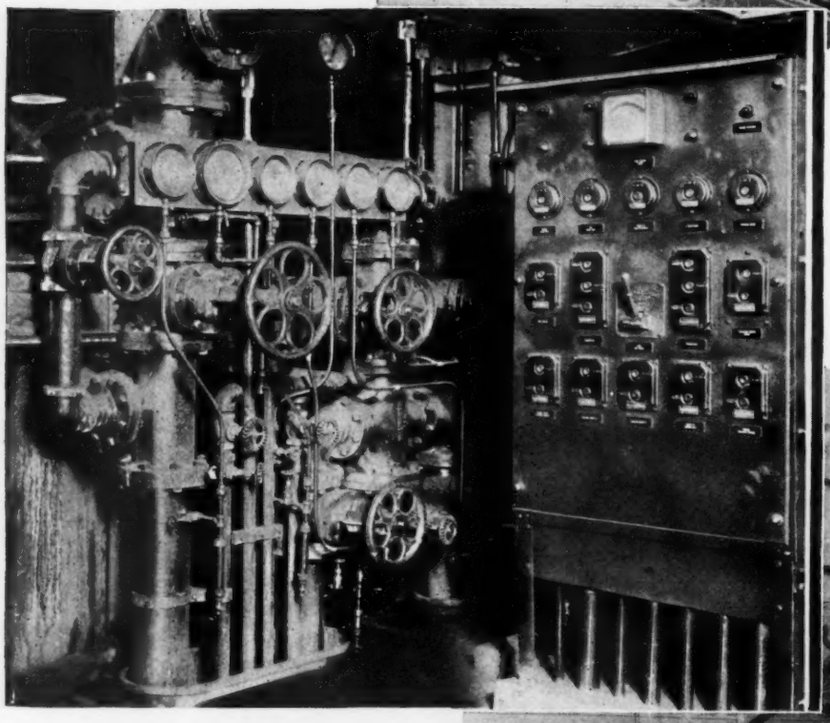
The 24 circuits leaving the main switchboard feed group buses located at centers of local distribution, from which individual circuits are extended to the motors. The assignment of motors to various main circuits and group buses is such as to group the motors which are interlocked to prevent piling up of coal and injury to



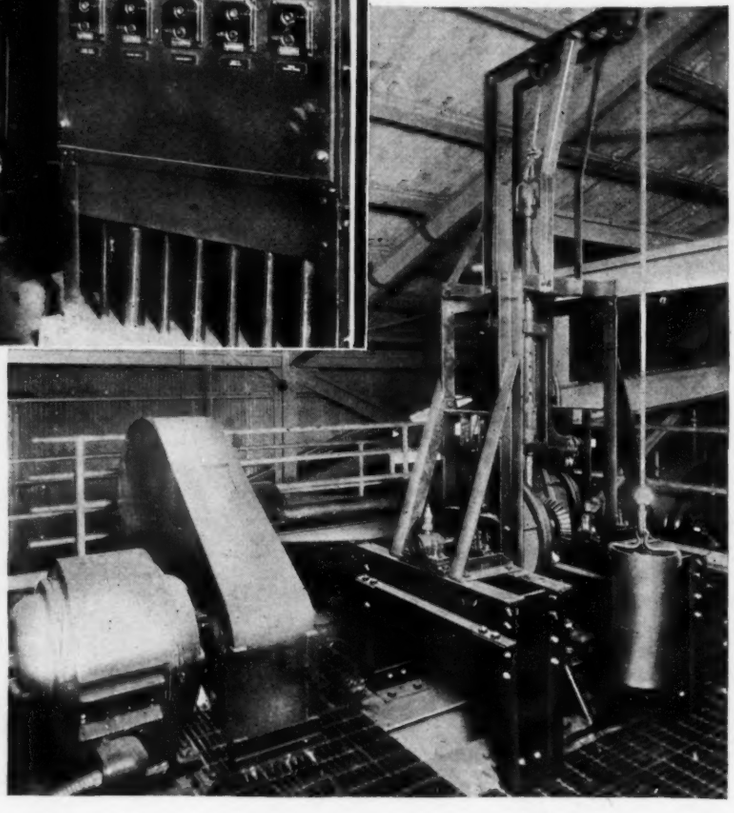
Drive for lump-coal shaker at cleaner plant



Small cone sand pumps are direct-driven by drip-proof motors

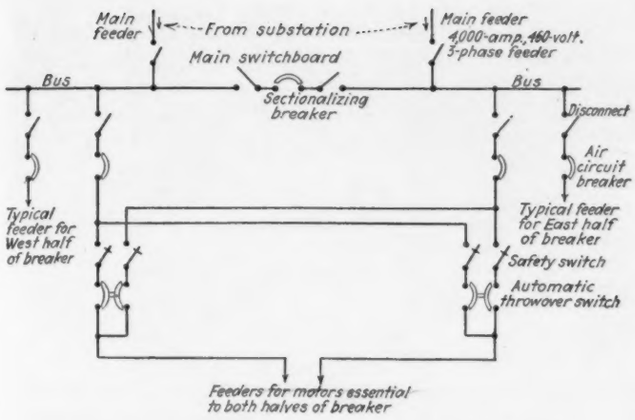


Control panel for primary cone



Primary cone refuse detector at right; primary cone drive unit at left

Automatic control of valves for removal of refuse depends on detector and associated electrical contacts governing valve operation.



One-line diagram of basic wiring scheme, central breaker

equipment in case the sequence of the production process is interrupted.

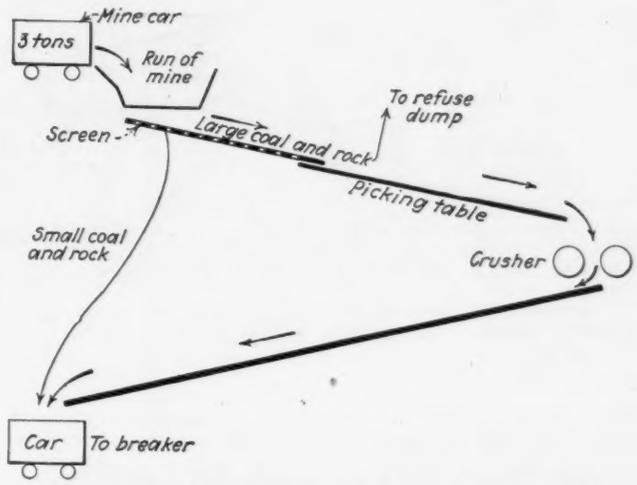
To enable motors and controls to be isolated from all sources of supply for repairs or inspection a safety switch is provided for each motor. In cases where the motors are interlocked each group is provided with a common safety switch, and where interlock wires are extended from one group of motors to another a safety switch for the interlock wires is provided at each group.

Protection of motors

Motors are protected by two-pole thermal overload relays and three-pole magnetic contactors. After the operation of an overload relay the relay can be reset by a button at the control station of the motor. Undervoltage protection is provided by connecting the contactors for momentary contact push-button operation. Fuses of heavy capacity are provided for each motor to serve as a back-up to the contactor, in case of short circuit. The fuses are rated at from two to four times the rating of the thermal relay and will, therefore, not blow except under unusually severe conditions.

Motors and controls

Conveyors and machines peculiar to the coal preparation process require high starting torque and are provided with high-torque, double-squirrel-cage motors. Pumps and other low-starting torque machines are provided with low-current, double-squirrel-cage motors in the larger sizes and standard single-squirrel-cage motors in the smaller sizes. The variable-speed feeders which govern the rate of coal flow entering the plant are driven by wound-rotor induction motors. Synchronous motors are used for the large circulating water pumps.



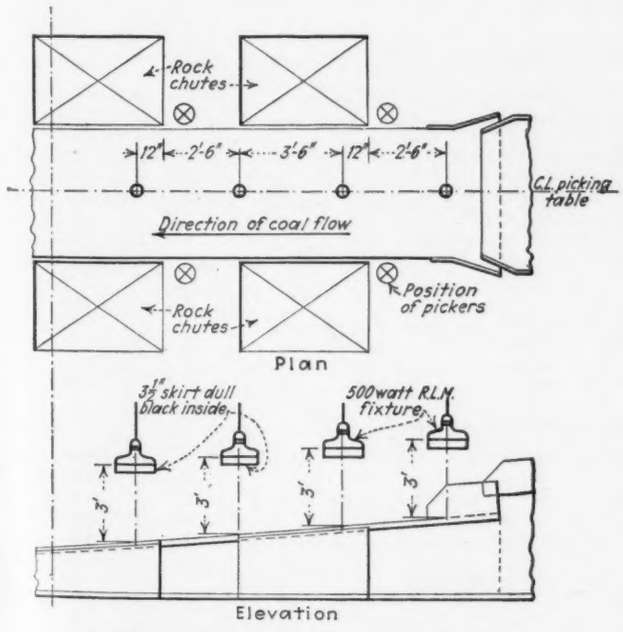
Elements of anthracite cleaner plant process

The high-torque, double-squirrel-cage motors are designed for a starting torque of 250 per cent of the running torque, while the low-current, double-squirrel-cage motors have a starting torque equal to 150 per cent of the running torque. All the squirrel-cage motors are started across the line except two 200-hp. motors which are provided with automatic starting compensators. The variable-speed motors are started by the use of secondary resistance and the synchronous motors have automatic starting panels.

Push-button control stations are located directly at the motors which they control in case of pumps, service equipment and a few of the process machines. The majority of the process motors have their control stations grouped at important operating points convenient for the starting and control of the breaker.

Use of interlocks

Interlocks are provided in all cases where the accidental shut-down of a machine would result in piling up of coal and are operated to stop all motors driving equipment feeding coal to the apparatus which is shut down. This is accomplished in most cases by energizing the closing coil of the contactor of one motor from the motor side of the contactor of the other motor. As a result of the interlocks the motors can be started only in



Picking table utilizes 100 ft.-candles on working area

Operators at the picking table no longer are hampered by glare, since the reflector interiors visible to them are of dull black finish.

proper sequence, beginning in general at the discharge end of the coal breaker.

A number of interlocks are automatically by-passed by the proper throwing of gates, and in some cases by-pass buttons are provided for breaking certain interlocks to allow the independent operation of certain portions of the breaker.

All the electrical equipment and wiring are especially designed to withstand water, which is used abundantly in the preparation process.

CHARACTER OF MOTOR DRIVES FOR CENTRAL BREAKER

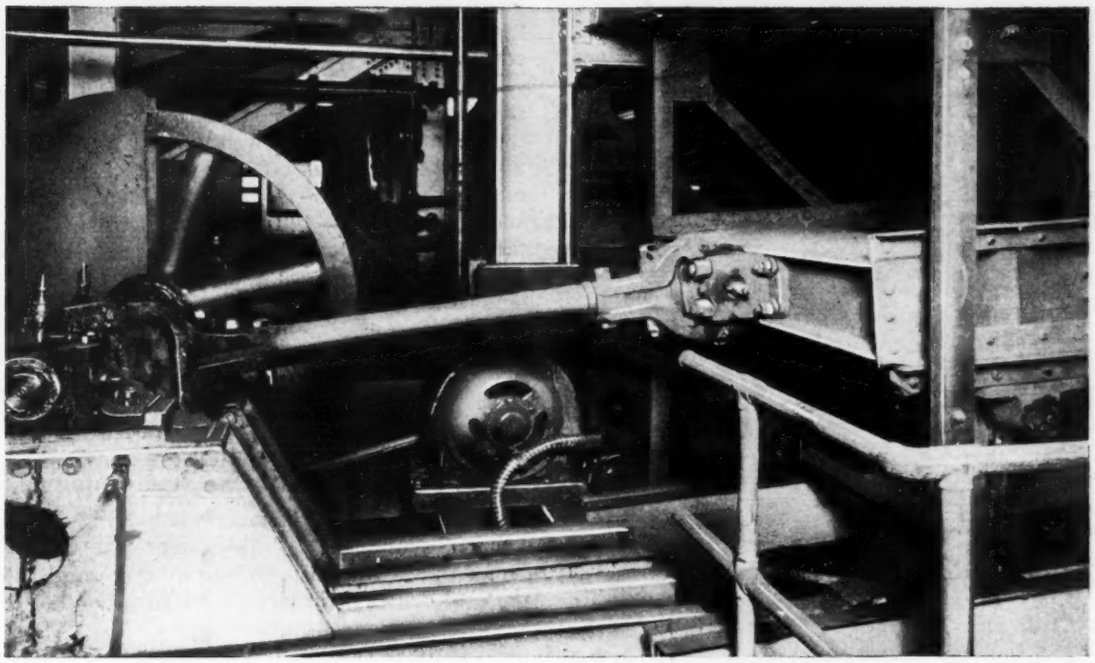
KEY TO ABBREVIATIONS

sc—standard squirrel cage; *dsc*—high torque, squirrel cage; *ssc*—low current, squirrel cage; *sl*—wound rotor; *syn*—synchronous

In general, all motors above 25 hp. were supplied by the General Electric Company and those below this rating by the United States Electrical Manufacturing Company. Three synchronous pump motors were made by the Westinghouse Electric & Manufacturing Company.

Process Machines	No.	Hp.	R.P.M.	Type
Primary cone agitators	2	40	900	dsc
Secondary cone agitators	4	25	900	dsc
Small cone agitators	4	20	900	dsc
Classifiers	8	7½	900	dsc
Deflatters	2	10	900	dsc
Deflatters	2	5	900	dsc
Thickener agitator	1	5	900	sc
Reciprocating Feeders and Screens				
Main conveyor feeders	4	10	1200	sl
Stripping conveyor feeder	1	10	900	sl
Stripping apron feeder	1	15	900	dsc
Primary scalping screen feeder	1	20	900	dsc
Primary scalping screens	4	25	900	dsc
Primary desanding and No. 2 scalping screen	2	30	900	dsc
No. 3 scalping screen	2	25	900	dsc
Secondary cone feeders	2	15	900	dsc
Secondary feed screens	4	20	900	dsc
Final sizing screens	8	30	900	dsc
Rice and barley screens	4	10	900	dsc
Desilting screens	8	5	900	sc
Pea and buck screens	2	10	900	dsc
Primary refuse screens	2	10	900	dsc
Secondary refuse screens	2	10	900	dsc
Secondary refuse screens	2	15	900	dsc
Hydrotator dewatering screen	2	10	900	dsc
Small refuse screens	2	10	900	dsc
Flats feeders	2	5	900	dsc
Loading boom distributing feeders	1	15	900	dsc
Loading boom distributing feeders	3	25	900	dsc
Refuse	2	30	900	dsc
Rice and barley bin feeders	4	5	900	sc
Primary refuse picking table feeder	1	10	900	dsc
Sand screen	1	2	1800	sc
Sand screen	1	1	1200	sc
Roll Crushers				
No. 2	2	50	900	dsc
No. 3	2	50	900	dsc
Bone	2	30	900	dsc
Refuse	2	30	900	dsc
Primary refuse No. 1	1	25	900	dsc
Flats	2	25	900	dsc
Pure coal	1	30	900	dsc
Belt Conveyors				
Main raw coal	2	150	900	sl
Stripping coal	1	50	900	dsc
Stripping and bone	1	50	900	dsc
Refuse	4	10	900	dsc
Flats collecting	2	3	900	dsc
Loading booms	5	5	900	dsc
Pea coal	1	5	900	dsc
Bone	2	3	900	dsc
Prepared coal	2	10	900	dsc
Refuse to bank	1	50	900	dsc
Refuse to bank	1	100	900	dsc
Drag Conveyors				
Pea and buck	2	30	900	dsc
Recirculating	2	30	900	dsc
Rice and barley	2	30	900	dsc
Coal spillage	1	5	900	dsc
Silt	2	5	900	dsc
Hydrotator screw	2	7½	1200	dsc

Loading and Unloading Equipment	No.	Hp.	R.P.M.	Type
Loading boom hoists	5	5	900	dsc
Box car loader tip	1	50	900	sl
Box car loader clamp	1	20	900	sl
Car Retarders	8	1	1200	sc
Car pullers	3	10	1200	sc
Rotary car dumper	2	45	720	sl
Process Pumps				
Circulating water	3	250	900	syn
Make-up water	3	60	1800	ssc
Circulating water	2	200	1200	sc
Primary cone 12-in. sand	2	75	900	ssc
Secondary cone 10-in. sand	4	50	900	ssc
Small cone 6-in. sand	4	20	900	sc
Primary refuse 4-in. sand	4	20	900	sc
Secondary refuse 4-in. sand	8	25	900	ssc
Small refuse 4-in. sand	4	20	900	sc
Hydrotator water	2	15	900	sl
Hydrotator refuse	2	5	900	sc
Overflow	4	30	1200	ssc
Sludge	2	20	600	dsc
High pressure flushing	1	40	1800	ssc
Traveling screen	1	3	1800	sc
Sampling and Testing Equipment				
Coal pulverizing	1	5	900	sc
Coal pulverizing	2	2	900	sc
Oven blower	1	2	1800	sc
Air heater	1	3	1800	sc
Sizing screen	1	5	1200	sc
Service Equipment				
Fresh water pump	1	25	1800	ssc
Elevator	1	36	240/720	sl
Condensate return pump	1	5	1800	sc
Condensate return pump	1	1½	1800	sc
Air compressors	2	75	1200	ssc
Ventilating fan	1	1½	720	sc
Ventilating fan	1	¼	1800	sc
Drinking water cooler	1	¾	1800	sc
Drinking water cooler	2	½	1800	sc
Unit heaters	8	2	1800	sc
Unit heaters	2	1½	1800	sc
Unit heaters	2	¾	1800	sc
Sump pumps	2	5	1800	sc
Sump pumps	3	1½	1800	sc
Sump pumps	5	¼	1800	sc
Boiler-House Equipment				
Boiler forced-draft fans	2	15	1200	sc
Air furnace forced-draft fans	2	25	1200	ssc
Air furnace induced-draft fans	2	40	900	ssc
Air supply fans	2	50	1200	ssc
Air preheaters	2	2	1800	sc
Machine Shop Tools				
Saw	1	1	1800	sc
Hammer	1	1½	1200	sc
Drill press	1	2	1200	sc
Emery wheel	1	2	1200	sc
Boring machine	1	2	1200	sc
Lathe	1	3	900	sc
Planer	1	2	1200	sc



Typical motor and drive for shaking feeder

A signal dispatching system and an intercommunicating telephone system are provided, each with specially selected loud-sounding horns.

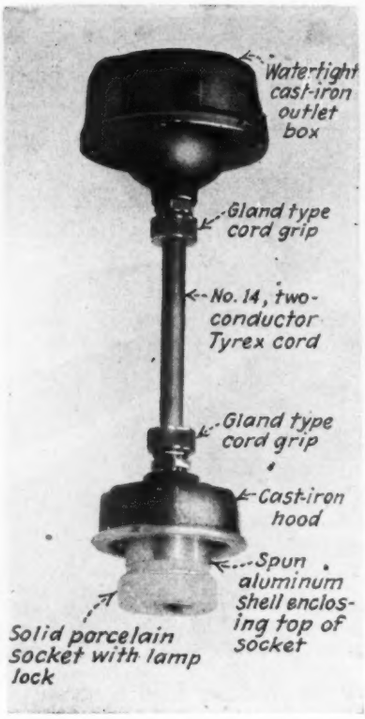
Wattmeters indicate coal-flow rate

Wattmeters are provided for roughly indicating the rate of flow of incoming material on the raw-coal conveyors of the breaker. These instruments are energized by the potential and current taken by the conveyor motors. The scales are calibrated in tons of coal per hour, the pointers being set to read zero with the belts running empty.

The lighting of the central breaker is provided from two 100-kva. transformers. Each transformer supplies half the building lighting under normal conditions, but an automatic throw-over switch is provided for transferring the entire lighting load to one transformer in case of trouble. The lighting system is 220-110-volt, single-phase, three-wire, with solid grounded neutral. Two main distributing panels are installed in the switch-

CHARACTER OF MOTOR DRIVES FOR CLEANER PLANTS

Locust Summit	No.	Hp.	R.P.M.	Type
Lump coal shaker	1	25	900	dsc
Picking table	1	15	900	dsc
Roll crusher	1	60	900	dsc
Dust collector	1	5	1800	sc
Unit heaters	2	1½	1800	sc
Alaska Cleaner				
Reciprocating feeder	1	10	1200	sl
Lump-coal shaker	1	25	900	dsc
Picking table	1	15	900	dsc
Countercoal shaking chute	1	25	900	dsc
Roll crusher	1	60	900	dsc
Loading boom hoists	2	3	900	dsc
Car retarders	2	1	1200	sc
Dust collector	1	5	1800	sc
Car retarder	2	1	1200	sc
Car puller	1	10	1200	sc
Unit heaters	3	1½	1800	sc
Reliance Cleaner				
Reciprocating feeder	1	10	1200	sl
Lump-coal shaker	1	25	900	dsc
Picking table	1	15	900	dsc
Countercoal shaking chute	1	25	900	dsc
Roll crusher	1	60	900	dsc
Dust collector	1	5	1800	sc
Unit heater	1	2	1800	sc
Unit heater	1	1½	1800	sc
Belt conveyor	1	60	900	dsc
Shaking chute to booms	1	20	900	dsc
Loading booms	2	7½	1200	sc
Loading boom hoists	2	3	900	dsc
Car retarders	2	1	1200	sc
Car puller	1	10	1200	sc
Potts Cleaner				
Belt conveyor	1	75	900	dsc
Shaking chute to booms	1	20	900	dsc
Loading booms	2	7½	1200	sc
Loading boom hoists	2	3	900	dsc
Car retarders	2	1	1200	sc
Car puller	1	10	1200	sc
Locust Gap Cleaner				
Reciprocating feeder	2	10	1200	sl
Lump-coal shaker	2	25	900	dsc
Picking table	2	15	900	dsc
Countercoal shaking chute	2	25	900	dsc
Roll crusher	2	60	900	dsc
Boiler fuel screens	2	15	900	dsc
Boiler fuel screens	2	5	900	dsc
Dust collectors	2	5	1800	sc
Unit heaters	3	1½	1800	sc
Belt conveyors	2	25	600	dsc
Belt conveyor	1	50	1200	dsc
Shaking chutes to booms	2	20	900	dsc
Loading booms	2	7½	1200	sc
Loading boom noists	2	1	900	dsc
Car puller	1	10	1200	sc
Car retarder	2	1	1200	sc
Car haul	1	100	720	sl
Loaded feeders and trip makers	4	25	900	dsc


Water-tight cast-iron outlet box
Gland type cord grip
No. 14, two-conductor Tyrex cord
Gland type cord grip
Cast-iron hood
Spun aluminum shell enclosing top of socket
Solid porcelain socket with lamp lock

Waterproof lighting fixture specially designed for anthracite preparation service

All fixtures are supported by No. 14 duplex "Tirex" cable ⅝ in. in diameter and are designed to permit cleaning by a stream of water from a hose.

board room, and risers from these panels feed distribution cabinets at convenient points of distribution and control.

Floodlighting units are installed for the railroad car storage yards, outdoor substation and grounds around the central breaker. Twenty-one Crouse-Hinds 1,000-watt units and five 500-watt units are used. They are mounted on steel structures with all units about 80 ft. above the ground. The two floodlighting structures for the outgoing storage yard are placed about 2,500 ft. apart and their units are connected to two independent circuits so that the intensity of illumination can be varied to meet operating or policing conditions, about half the projectors being lighted in the latter case. The lamp voltage is 110 and the entire installation is designed for an average effective illumination of 0.08 lumen per square foot.

Cleaner plants completely equipped

The five tributary cleaner plants feeding the central breaker receive the run-of-mine coal, separate large lumps of rock from it and after screening and crushing the coal deliver it in large sizes (6 in. or less diameter) to cars to be hauled to the breaker. Typical as to equipment is the so-called Alaska cleaner of this group, which has sixteen motors installed, aggregating about 180 hp., and ranging from 60 hp. to 1 hp. for car retarder service.

▼ ▼ ▼

Programming Construction

By E. A. CRELLIN
Assistant Engineer
Pacific Gas & Electric Company, San Francisco, Calif.

IN ORDER that interest during construction be kept at a minimum and capital placed on a productive basis at the earliest moment consistent with construction economies, the program of design, purchase and construction on any large job must be carefully considered and planned. It is rarely possible to complete the purchase and installation of equipment in a major power plant in less than one and a half years. When a hydro project is involved, this period is usually extended, due to the time required for the construction of dams, tunnels, waterways, etc., upon which the rate of construction progress is governed by the amount of equipment and man-power which can be economically employed.

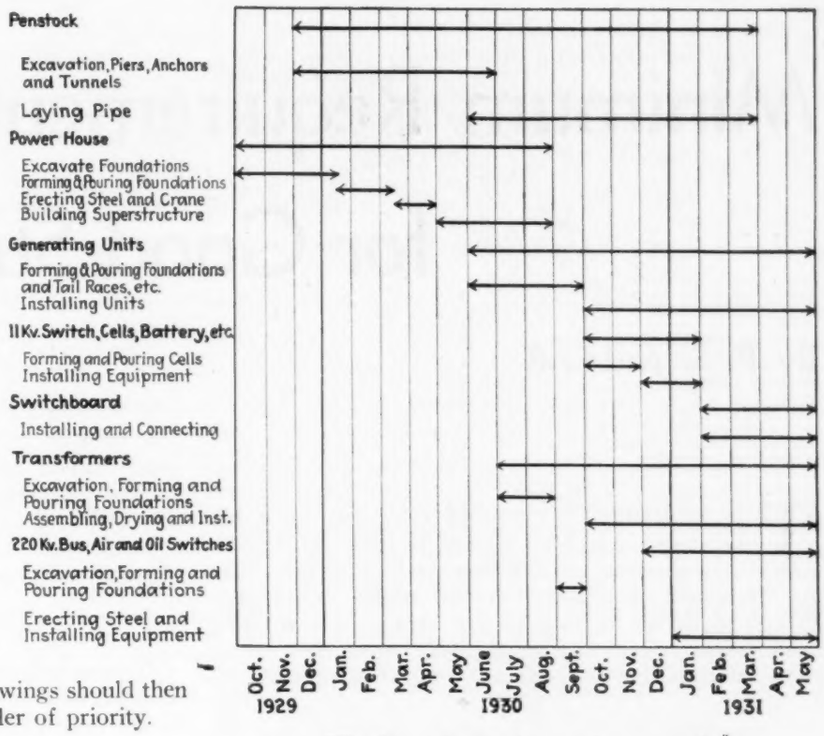
When the need for additional generating capacity is determined and the nature and location of the plant decided upon, a tentative date for completion can be set. This forms the starting point from which the engineer and constructor must jointly work out the construction program. The constructor will first consider the main divisions of the plant and estimate the length of time for the installation or completion of each part. This time is usually determined by adding up the time required for excavating, forming and pouring foundations and erecting or installing the equipment. A typical estimate of this character is shown in the accompanying illustration.

With the time for installation determined, the engineer can set the dates for delivery on the job of the several items and main equipment entering into the project. The engineer must then make up a second schedule, breaking the constructor's schedule down into smaller subdivisions if necessary, and proceed to estimate the time required for fabrication and delivery, design, specification and purchase. Such a schedule is shown here.

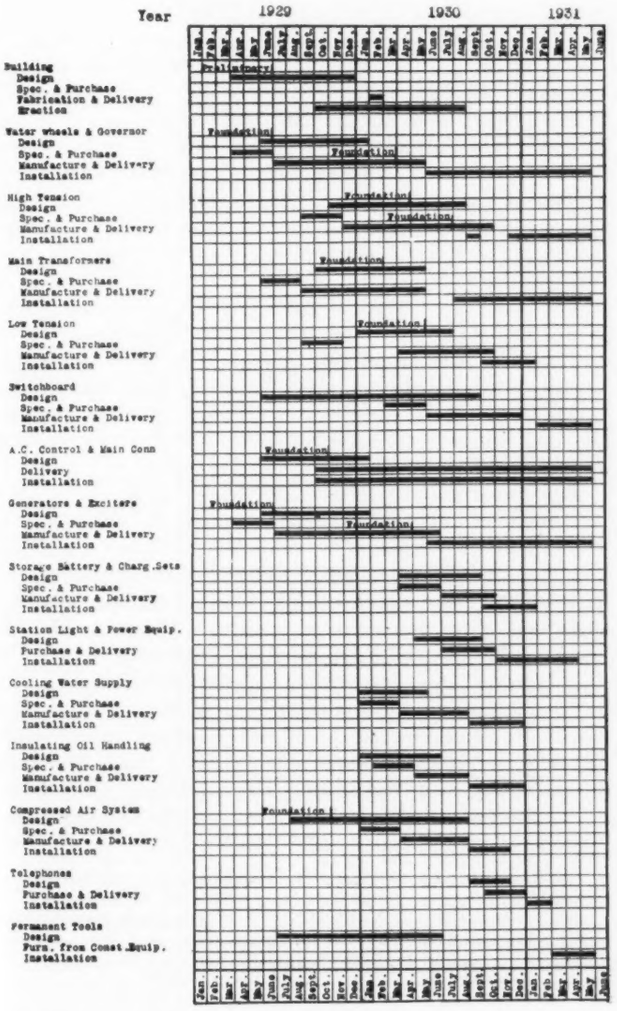
This at once fixes the priority of equipment purchases, those requiring the greatest over-all time for complete installation naturally taking precedence. Specifications are written and orders placed at such times that the equipment will be delivered on the job at the specified date. By securing delivery of equipment at a time when construction progress has reached the point where installation can proceed at once two important objects are achieved: First, there is a direct monetary saving due to the minimum time of unproductive employment of the capital invested in the equipment, and, second, construction progress is facilitated by eliminating the necessity for storage of the equipment at the site pending preparations for its installation. Storage space is usually at a premium on a major construction job, particularly if it be a hydro-electric project in a mountainous country, and frequent handling and rehandling of stored material should be avoided for many reasons.

The engineer's schedule will also show him the priority

for design drawings and will enable him to plan his work accordingly. A list of all drawings required for the project is made and the estimated time for the completion of each is set down. The number of man-hours required for drawings can be thus determined, the size of drafting-room squad fixed and the work started, with a fair degree of assurance that each drawing will be in the constructor's hands on or before the day it is required. Co-operation between the engineer and constructor in the fixing of priority of drawings is of very great advantage to all concerned. Obviously, excavation and foundation drawings are the first to be required on the job, and these should take precedence over other drawings. In order to secure the necessary data for the completion of foundation drawings, other drawings must be started and carried to a point where definite arrangements and dimensions can be fixed. These drawings should then be laid aside and completed in their order of priority.



Working back from the completion date, the constructor time-schedules his job as here charted



Program made by combining construction time schedule with the designer's program

The work of the constructor can be greatly facilitated by the submission of blueprints of partially completed drawings. These prints should be distinctly marked as "not approved for construction" and "subject to change." Their purpose is to convey to the constructor a general idea of what the finished plant will look like well in advance of the receipt of approved construction drawings, to the end that he may work toward the given objective. A foundation drawing conveys little information as to what the equipment it will support is going to look like. In working up the details of the foundation it is necessary to make considerable progress on the final equipment layout drawing. A print of this partially completed drawing is of material assistance to the man in the field in visualizing the completed foundation.

Co-operation between the engineer and constructor of a major power project is essential if the job is to be completed on scheduled time. Progress can continue in an orderly manner only when design drawings are available when needed and material is purchased far enough in advance to permit its delivery in accordance with a prearranged program. A construction schedule laid out as indicated in the accompanying charts jointly by the constructor and engineer permits an intelligent co-operation in bringing a new plant on the line to furnish power on the day it is required.

Minimum Requirements* for Good Street Lighting

By P. S. MILLAR

Chairman I.E.S. Street-Lighting Committee

TREMENDOUS growth of vehicular traffic has occasioned advances in the building of streets, thoroughfares and highways, which in turn have facilitated and encouraged vehicular traffic. With some exceptions, street lighting has not kept pace with traffic requirements. In consequence many streets are not as safe, effective and convenient by night as they should be. Because of the lack of adequate street lighting motorists have been forced to employ powerful and far-reaching headlights. Such private lighting is by no means a solution of the problem. When the headlights are glaring they are detrimental to safety, comfort and appearance of the street. Upon adequately lighted streets the use of depressed headlight beams or of side lights only is desirable and should be required.

As it is now practicable to provide adequate illumination of streets from fixed lamps, a proper self-respect and sense of civic responsibility require that streets should be so lighted that they may carry their traffic with safety and convenience without reliance for illumination upon private portable lights, either for pedestrians or for vehicles. Where this is done street lighting reduces traffic accidents, provides a crime deterrent, encourages development of business districts, enhances property values and makes more effective use of the large investment in street and highway construction.

Lighting fundamentals

The lighting for a street should be designed with due regard to the type of street and its traffic, to the characteristics of the street surface, to the types of buildings along the street and to the presence or absence of trees. It should be made adequate to permit local authorities to require that powerful automobile headlights be depressed or dimmed. For a proper understanding of lighting requirements the characteristic modes of seeing in streets at night should be considered. Lighting units should be located at optimum heights and transverse positions and should be spaced properly. Luminaires are more effective when mounted over roadways than when back of the curb lines. Hence upright luminaires back of the curbs usually should be equipped with larger lamps or should be spaced closer together than pendent luminaires located over roadways. Lamps should be equipped with accessories of types best suited to apply the available light to the maximum accomplishment of the purposes stated. Glare should be minimized. The appearance of the street-lighting equipment and of the street as affected by the lighting equipment should meet esthetic requirements. Finally, economy of installation and operation should be sought.

Qualifying provisions

It is stated repeatedly in the accompanying recommendations that they are based on the use of equipment of the most effective type in the most effective manner. With less effective equipment or less effective application of light, larger lamps or closer spacings are required. It should be specially noted that where luminaires are indicated to be placed on brackets extending out beyond the curb, the light is being used in an effective manner; when placed back of the curb, the effectiveness is reduced. The latter placement will usually call for the next larger size of lamp or for closer spacing than mentioned in the specifications. This is not to say that location of post-type lighting units back of the curb is never to be advocated. Such location may be made effective but usually requires the employment of larger lamps or closer spacings. When upright post-type units are used, a somewhat lower mounting height may be adopted, although a 16-ft. mounting height in business streets is justified only where one-story buildings predominate.

With increased height a somewhat greater spacing between units is permissible, provided the candlepower of the lamps is increased proportionately.

The obstruction of light by foliage when luminaires are mounted at heights recommended in this code is sometimes the occasion for adoption of lower mounting heights. While deprecating indiscriminate trimming of trees to facilitate street lighting, the committee feels that judicious trimming of trees with this object in view is to be advocated where feasible as a preferable alternative to mounting lamps lower than recommended.

The minimum recommendations in this code are intended to apply to usual and representative conditions. As it does not seem practicable to adopt sharp divisions between streets of the several classifications, the following qualifications should be kept in mind when considering these recommendations:

As traffic density increases it is desirable to use somewhat more light.

With a given traffic density on streets of a given classification more light should be provided for unusually wide streets.

Where headlight laws restricting glaring beams are not enforced somewhat more light should be provided.

**Excerpts from Street-Lighting Code presented at annual convention of Illuminating Engineering Society, Richmond, Va.*

Where the number of pedestrians is unusually large for a given street classification more light should be provided.

Where there are surface car lines more light should be provided, the increase depending upon the frequency of car service.

Where there is only one-way traffic less light may be used.

Where parking of automobiles is not permitted slightly less light may be supplied.

Where unlighted safety zones are provided somewhat more light should be supplied. If the safety zones are identified by lights, this is not required.

Recommended Practice

Prepared by committee on street lighting (P. S. Millar chairman), Illuminating Engineering Society

The accompanying recommendations for street lighting should be understood to be minimum recommendations. It is the opinion of the committee on street lighting that it is clearly desirable to provide more than these minimum recommendations wherever feasible. Such better lighting is entirely justified by the increased safety, effectiveness and convenience which are afforded to those using the streets at night. Any permanent street-lighting installation which is based on the following recommendations should be planned so that it will be possible to increase materially the lighting intensity, for it is well known that the standards of street-lighting practice are increasing at a rapid rate. There are many street-lighting installations throughout the country which now exceed the code recommendations, and the committee on street lighting advocates such better lighting installations as being in the public interest.

Light-Traffic Thoroughfares. — For light-traffic thoroughfares the minimum recommended is a staggered arrangement of lighting units with luminaires located on brackets extending out beyond the curb at a mounting height of not less than 18 ft. With this mounting height the spacing should not be greater than 150 ft. With such mounting height and spacing the lamp rating should not be less than 4,000 lumens (400 candles). On narrow thoroughfares (as 25 ft. between curbs) lighting units may be located on one side of the street, although better results will be obtained if the units are staggered.

This specification is based upon the use of equipment of the most effective type in the most effective manner. With less effective equipment or less effective application of light larger lamps or closer spacings are required. The minimum mounting height of 18 ft. should be employed only where trees are present or other conditions make a higher mounting height impracticable. Mounting heights between 20 ft. and 25 ft. are recommended where practicable.

Medium-Traffic Thoroughfares.—For medium-traffic thoroughfares the minimum recommended is a staggered arrangement of lighting units with luminaires located on brackets extending out beyond the curb at a mounting height of not less than 18 ft. With this mounting height the spacing should not be greater than 150 ft. With this mounting height and spacing the lamp rating should not be less than 10,000 lumens (1,000 candles). This specification is based upon the use of equipment of the most effective type in the most effective manner. With less effective equipment or less effective application of light larger lamps or closer spacings are required.

The minimum mounting height of 18 ft. should be adopted only where trees are present or other conditions make a higher mounting height impracticable. Mounting heights between 20 ft. and 30 ft. are recommended. For lamps of 10,000 lumens or more higher mounting heights than 18 ft. become particularly important and should be adopted where practicable.

Heavy-Traffic Thoroughfares. — For heavy-traffic thoroughfares the minimum recommended is an opposite arrangement, or equivalent, of lighting units with luminaires located on brackets extending out beyond the curb at a mounting height of not less than 18 ft., even where trees are present. With this mounting height the spacing should not be greater than 150 ft. on each side of the street. With such mounting height and spacing the lamp rating should not be less than 10,000 lumens (1,000 candles). This specification is based upon the use of equipment of the most effective type in the most effective manner. With less effective equipment or less effective application of light larger lamps or closer spacings are required. Where trees do not interfere mounting heights between 20 ft. and 30 ft. are recommended. With lamps of 10,000 lumens or more higher mounting heights than 18 ft. are particularly important and should be adopted where practicable.

Basis for Classification of Streets

For purposes of classification traffic should be studied during the lighting hours of a typical week. Vehicle counts for this purpose should be made in that hour of the week carrying maximum traffic during the lighting period. On the basis of such traffic counts the following are considered usable definitions:

Light-Traffic Thoroughfares.—Not more than 500 vehicles per hour in both directions.

Medium-Traffic Thoroughfares. — A maximum of approximately 800 to 1,200 vehicles per hour in both directions.

Heavy-Traffic Thoroughfares. — A maximum of more than 1,500 vehicles per hour in both directions.

Residence Streets (Non-Thoroughfares).—For residence non-thoroughfare streets the minimum recommended is an 18-ft. mounting height for luminaires located on brackets extending beyond the curb, even where trees are present. With this mounting height the spacing should not be greater than 150 ft., although conditions may sometimes necessitate spacings as great as 200 ft. With such mounting height and spacing the lamp rating should not be less than 2,500 lumens (250 candles). This specification is based upon the use of equipment of the most effective type in the most effective manner. With less effective equipment or less effective application of light larger lamps or closer spacings are required. At closer spacings a lower mounting height, not less than 15 ft., is permissible. Also 1,000-lumen lamps may be used at the minimum mounting height of 15 ft. and closer spacings, preferably not exceeding 125 ft.

Where luminaires are used on center suspension, the mounting height should be not less than 22 ft. and preferably not less than 25 ft.

At intersections of residence streets carrying only local traffic not less than one 4,000-lumen or two 2,500-lumen lamps should be installed.

Business Districts. — Business streets should be classified as to vehicular traffic in a manner similar to that adopted for thoroughfares, and the same minimum standards of illumination should apply for each class, due consideration being given to other local conditions. Retail business streets should never be lighted to a lower standard than that for medium-traffic thoroughfares. Where there is considerable pedestrian traffic these minimum values should be increased.

If the luminaires are not placed over the roadway, lamp sizes should be increased. For a given size of lamp the minimum mounting height should be as follows:

For Lamps of	Not Less than
25,000 lumens and over.....	24 ft.
15,000 lumens	20 ft.
10,000 lumens and less.....	*16 ft.

*This 16-ft. minimum mounting height is justified only where one-story buildings predominate.

Alleys.—Alleys in business and industrial sections and the entrances, exits and intersections of public alleys in residence districts should be lighted.

Highways.—For the lighting of highways having pavement widths of 22 ft. or less, the minimum recommended is an arrangement of luminaires located at mounting heights of 28 ft. or more and not more than 10 ft. from a point over the middle of the highway. With this mounting height the spacing should not be greater than 325 ft. With such mounting height and spacing 4,000-lumen lamps should be considered the minimum.

When physical conditions do not permit mounting at such heights luminaires may be mounted lower (minimum 22 ft.) and with closer spacing. For closer spacing 2,500-lumen lamps may serve.

This specification is based upon the use of equipment of the most effective type in the most effective manner. With less effective equipment or less effective application of light larger lamps or closer spacings are required.

For broad highways carrying heavy traffic thoroughfare requirements, including a staggered arrangement of lighting units, as stated above, should prevail. Luminaires should never be mounted farther from a point over the middle of the highway than the edge of the pavement. In proportion as highways are broad and traffic is heavy it is important to employ larger lamps, to mount them higher and to space them more closely.

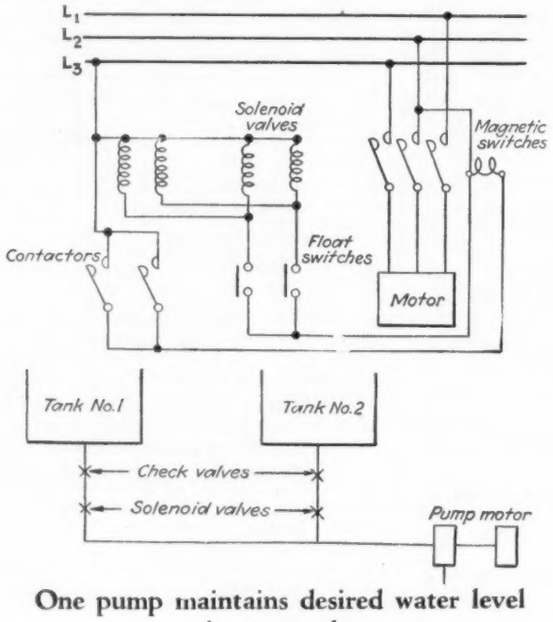
On curved highways luminaires should be mounted over the outside of the curve.

Control System Eliminates Pump and Motor for Fire Tank

By S. J. KESTER
General Electric Company, Denver, Colo.

WHERE two or more water tanks for fire protection are located in the same or adjacent buildings a saving in equipment can be effected by connecting the tanks to the same pump and using an automatic electric pumping and control system for maintaining the proper water level in each tank

Such an installation was recently laid out for the Crane-O'Fallon Company, Denver, where it was desired to supply two tanks in different buildings with the same pump. A centrifugal pump and motor were already installed, together with a magnetic switch for starting the motor. In order to operate the pump so as to maintain the desired level in the tanks, a 2-in. solenoid-operated valve equipped with oil dashpots to prevent water hammer was installed in the pipe line to each tank to operate in conjunction with the motor and starting switch, which are controlled by float switches.



One pump maintains desired water level in two tanks

This equipment operates as follows: In event one of the float switches completes its circuit because of low water in its tank, the solenoid of the valve in the pipe line to that tank is energized and the valve opens. At the same time one of the contactors is energized and its contacts closed, thus completing the circuit to the magnetic starting switch conrolling the motor. This starts the motor and water is pumped to the empty tank. The same sequence will occur for low water in the other tank. In case the water becomes low in both tanks at the same time, both solenoid valves will be opened and water pumped to both tanks, each valve being de-energized and closed when the water comes to the proper height in its respective tank.

READERS' FORUM

Breakers for Branch Circuits Needed to Improve Service

To the Editor of the ELECTRICAL WORLD:

A reduction in the number of interruptions to service is the goal toward which all central-station operators strive. Great strides have been made in operating practices and in standards of equipment, with the result that nowadays few serious general system failures occur. The last links in the chain between power station and lights or appliances are the protective devices on customers' premises, and it is the failure of these that is annoying to customers and costly to utilities. Prompt attention to calls from householders that "lights are out" or "iron does not heat" reduces somewhat the irritation, but obviously this will incur some cost.

The familiar plug and cartridge fuses have, almost since the inception of the industry, been the standard protection against overcurrents. With development in wiring practices the use of the fuse has been rendered easier and more safe. In spite of this there are scores of times when the utility is called upon to replace fuses because the user of the service does not know how to do it, or does not want to, and is consequently without service until the trouble man arrives. A large number of these calls would be eliminated if restoring service were no more complicated than turning on a light.

It would, therefore, appear that some simple circuit breaker of proper characteristics and of such extreme simplicity of operation that any individual could reset it is the answer to a demand to supplant fuses.

Any small breaker should hold loads of its rated capacity indefinitely. To accomplish this it would be good practice to make one that would hold loads of 105 to 110 per cent of capacity indefinitely as well. Loads in excess of 110 per cent rated capacity should be interrupted after a time delay, the delay being roughly in inverse ratio to the overload. The device should open instantly under such short circuits as would occur in the ordinary home or small store and should handle these "shorts" without excessive damage to parts. Once the breaker has responded to an overload it should be impossible for it to be held "in" against the overload.

Another point to remember is that, under ordinary circumstances, long periods (perhaps several years) may elapse between operations. Regardless of this, the device should be ready for duty when called upon.

Small circuit breakers, such as have been discussed, are now available and have been adapted to the 30-amp. meter-service entrance switch and at a cost comparable to that of the knife-blade switch and fuse. It is evident, however, that the application must be carried to the branch circuits before a satisfactory solution is reached. Here the cost differential in favor of the fuse becomes a serious handicap to the breaker. The problem, then, is to produce a small circuit breaker low in first cost, small in size, reliable in operation and of such evident practicability that its merits will speak for it.

Detroit, Mich. **W. G. KNICKERBOCKER.**

Men of the Industry

J. S. Ware Succeeds the Late Mr. Sproule in Newark

JOHN S. WARE, assistant general superintendent of distribution, electric department, Public Service Electric & Gas Company, has been appointed general superintendent of distribution to succeed the late Thomas Sproule. Mr. Ware was born in Mauricetown, N. J., and was graduated from Stevens Institute of Technology in 1910. Immediately after the completion of his technical education he took a position with Public Service as record clerk in the electric distribution department in

the River Street office, Newark. He became distribution engineer in the general office in 1916 and on February 1, 1926, when Mr. Sproule was made general superintendent of distribution, Mr. Ware was made his assistant.

Mr. Ware is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society and the American Wood Preservers' Association. He is a member of the executive committee of the overhead systems committee of the National Electric Light Association and a representative of that committee on the American Standards Association's committee on wood poles.

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J. L. PRITCHETT has been appointed manager of the Lynchburg Traction & Light Company, Lynchburg, Va., to succeed C. D. Thomas, who resigned to assume new duties in Chicago. A graduate of Virginia Polytechnic Institute, Mr. Pritchett is at present connected with the Central Public Service Company in Chicago.

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A. E. Reynolds in Canada

A. E. REYNOLDS, for eight years vice-president and general manager of the Springfield Gas & Electric Company and the Springfield Traction Company, Springfield, Mo., has been appointed vice-president and general manager of the New Brunswick Power Company at St. John. The St. John company is a subsidiary of the Federal Light & Traction Company, New York City, as are the Springfield companies.

Mr. Reynolds began his public utility work in Plattsburgh, N. Y., with the Gas, Electric Light & Traction Company. Later he served as manager of the Plattsburgh Traction Company, as resident manager of the Hudson Valley Railway at Glens Falls, and subsequently as general manager of the United Traction Company with offices in Albany. He resigned this position in 1922 to become associated with the Federal Light & Traction Company and was immediately sent to Springfield. Mr. Reynolds has been honored in the public utility field, being past-president of the Midwest Electric Railway Association and past-president of the Missouri Association of Public Utilities.

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OWEN D. YOUNG, chairman of the board of directors of the General Electric Company, sailed for Europe October 18 aboard the *Leviathan*.

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WATSON F. TAIT, JR., assistant distribution engineer of the Public Service Electric & Gas Company, Newark, has been named assistant to the general superintendent of distribution. A graduate of Marietta College with an A.B. degree and of Lehigh University with an E.E degree, Mr. Tait entered the employ of Public Service as a cadet engineer in 1922. He spent two years in the electric generation and distribution departments before receiving an assignment to the office of John S. Ware, assistant superintendent of distribution. In 1928 he became assistant distribution engineer.

N. A. Perry Assumes Executive Duties in Holding Company

NORMAN A. PERRY, for the past four years president of the Indianapolis Power & Light Company, has resigned to become a vice-president of the Utilities Power & Light Corporation, of which the Indianapolis utility is a subsidiary. Mr. Perry is the son of one of the founders of the Indianapolis utility, Charles C. Perry, who established the Indianapolis Light & Power Company in 1892. He died in 1926 and Norman Perry relinquished the duties of secretary to become chief executive

of the company. He has varied interests in Indianapolis, being an officer of three banks and of several industrial companies. Mr. Perry also resigned as a director of the Indianapolis Power & Light Company. Clifford L. Harrod will succeed him as president.

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WILLITS H. SAWYER, formerly president of Stevens & Wood, Inc., has moved his office as executive engineer to 120 Broadway, New York City, where he will also be associated with R. P. Stevens & Company, Incorporated. In addition to his consulting activities in connection with the management problems of public utilities, Mr. Sawyer will give an appreciable portion of his personal time to the duties required by his recent appointment as co-receiver

of the Atlantic Public Service Associates, Inc., and will also continue as receiver for the Springfield (Ohio) Railway Company.

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D. S. WEGG, formerly connected with the American Cyanamid Company, is now chief engineer of Consolidated Laundries, New York.

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CARL P. SCHELLER has been named vice-president of the two largest companies of Potsdam, namely, the St. Lawrence Valley Power Corporation and the St. Lawrence County Utilities, Inc.

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R. J. S. PIGOTT has resigned as consulting engineer for Stevens & Wood, Inc. (now Allied Engineers) and has become staff engineer at the Gulf Research Laboratory, in charge of engineering research.

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W. S. JOHNSTON, for the past four years connected with Allied Engineers, Inc., has recently joined the engineering department of Stone & Webster as engineer in the mechanical division.

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EDWARD WRIGHT of Malone, N. Y., will succeed F. A. Stoughton, who has for some years been in active charge of the St. Lawrence group of public utilities and who will retire on November 1. Mr. Wright has been in charge of the Malone companies which are part of the Niagara Hudson system.

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H. E. MCDOWELL, who has been associated with the engineering department of the Texas Power & Light Company for ten years, has assumed new duties in the New York offices of the Electric Bond & Share Company. He will be sponsor engineer over Texas and Arizona properties of the organization which he now joins. Since establishing residence in Texas he has supervised both electric and gas problems of the company. A graduate of Lehigh University in 1917, Mr. McDowell was first connected with the Bethlehem Steel Company at Bethlehem, Pa., when the war interrupted his work. Following discharge from military service, he joined the Pennsylvania Power & Light Company at Allentown and after almost one year removed to Texas, where he entered the employ of the Texas Power & Light Company. He first worked as an estimator, then supervised the rebuilding of the gas system in Waco and later returned to Dallas, handling designing and construction work on various substations. During the illness of J. B. Thomas, chief engineer, he assumed charge of the engineering department with the title of acting chief engineer, and in 1928 he was appointed assistant chief engineer, which position he now relinquishes.

C. L. Cadle to Manage Associated Gas Properties

CHARLES L. CADLE, vice-president and general manager of the Rochester Gas & Electric Corporation, has been appointed general manager of all the Associated Gas & Electric Company properties in New York State. Mr. Cadle will continue as general manager of the Rochester property, although he will have an office in New York City. Mr. Cadle is a native of Mentor, Ohio, and a graduate of the Case School of Applied Science in Cleveland. His early work in the utility field was in the railway branch, at first with the Cleveland

Railroad Company and later with the Rochester lines of the New York State Railways. In 1919 he became chief engineer of the New York & Harlem Railroad Company, retaining the same position with the New York State Railways.

Mr. Cadle was appointed State Superintendent of Public Works on December 31, 1921, by Governor Miller. He served in that office about two years and was Republican candidate for State Engineer in the fall of 1922. He was defeated and returned to Rochester, where he became consulting engineer for the Rochester Gas & Electric Corporation. In the spring of 1924 he was made general manager and later vice-president and general manager, holding these offices during the Phillips-Olmstead control and up to the present time under the Associated ownership.

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DEAN E. BATCHELDER of Pittsburgh, Pa., who has been with the engineering department of the Westinghouse Electric & Manufacturing Company since his graduation from the Massachusetts Institute of Technology in 1928, has been appointed instructor in electrical engineering at the State Agricultural School, Fort Collins, Colo.

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OBITUARY

PHILANDER VAN BURINGTON, formerly secretary and treasurer of the Columbus (Ohio) Railway, Power & Light Company, died at his home in that city October 8. Mr. Van Burington retired five years ago after an association of 34 years with the Columbus utility.

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HANSON BOWIE, auditor of the Ohio-Edison Company, Youngstown, Ohio, died at his home in that city, October 7, in his fiftieth year. Mr. Bowie was appointed auditor two years ago of the associated companies of the Penn-Ohio System.

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RALPH E. THURSTON, who for 25 years had been associated with the electric light and power industry in Putnam, Conn., and who had been an outstanding citizen and public official there, died in the Fall River (Mass.) Hospital October 6, following an operation. Mr. Thurston was born in Fall River, Mass., in 1877 and was graduated from the Massachusetts Institute of Technology in 1902. After a few years with the Chicago Edison Company and the Narragansett Electric Light Company, he became superintendent of the Putnam Light & Power Company, which has since been merged into the Connecticut Light & Power Company.

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CHARLES A. MUDGE, general manager of the Electro Dynamic Company, Bayonne, N. J., died October 11, after an illness of three weeks, in his sixtieth year. A graduate of Cornell University, Mr. Mudge joined the Westinghouse Electric & Manufacturing Company in East Pittsburgh, subsequently affiliating himself with the Sprague Electric Company, where he engaged in railway motor design. In connection with this work he spent a number of years in Germany. After a connection with the General Electric Company in Schenectady, he became manager of the auto starting and lighting department of the U. S. Heat & Light Corporation of Niagara Falls, N. Y., in 1911. From 1917 to the time of his death he had been connected with the Electro Dynamic Company as general manager. Mr. Mudge was active in various associations, particularly the American Institute of Electrical Engineers and the National Electrical Manufacturers' Association, serving on special and standard committees of both organizations.

Financial and Statistical News

WHILE loans on securities made by member banks of the Federal Reserve System dropped ten millions as of October 15, other loans rose more than sixty millions, indicating some definite business expansion. This rather significantly reverses the process of last October.

——POWER AND LIGHT STOCKS ARE STILL ABOVE 1929 lows. Average of a representative group of listed holding company stocks is now (October 22) 55, against a high last year of 139 and a low of 48.

——SUBSTANTIAL UTILITY FINANCING IS IN PROSPECT. Columbia Gas & Electric will shortly sell a sixty-million debenture issue and Pennsylvania Power & Light a hundred-million issue, it is reported.

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New England Power Extends Influence

INCREASED FINANCIAL INTEREST in the Massachusetts Utilities Associates led to a joint announcement on Tuesday of last week by President Frank D. Comerford of the New England Power Association and Vice-President Bowen Tufts of the first-named organization that henceforth the Power Association will take a more active part in the management of the companies making up the "M.U.A.," as it is called in Boston financial circles. These companies include some fifteen central-station systems serving scattered small cities and towns in Massachusetts, among which are North Adams, Adams, Williamstown, Stockbridge, Clinton, Northampton, Uxbridge, Franklin, Plymouth, Amesbury, Marion and others. The banking house of C. D. Parker & Company, Inc., Boston, is identified with these utilities and has devoted considerable work to their co-ordination in the past few years, along with the Childs interests. A number of these systems are already wholesale customers of the New England Power Association.

The trustees of the Massachusetts Utilities Associates have elected the following new officers, who are also officials of the New England Power Association: President, William C. Bell, succeeding Arthur H. Wellman; treasurer, Carl S. Herrmann, succeeding Paul B. Webber; assistant secretary, R. S. Pattee, succeeding E. E. Allen, Jr.; assistant treasurer, H. H. Hanson, succeeding M. E. Grush.

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Central West Company Under New Control

PUBLIC UTILITY HOLDING CORPORATION OF AMERICA has acquired 50 per cent of the outstanding 200,000 shares of the voting stock of Central West Public Service Company, according to a joint announcement by F. S. Burroughs, president of the former organization, and Max McGraw, chairman of the board of the Central West Company.

Central West Public Service Company is a $20,000,000 organization, with operating headquarters in Omaha, and has heretofore been wholly owned by the McGraw interests, who will continue in the management. The Public Utility Holding Corporation is a holding company, formed a year ago by Harris, Forbes & Company, and United Founders interests.

The Public Utility Holding Corporation is represented on the board of directors of Central West Public Service Company by George Devendorf of American Founders Corporation and A. W. Mellen, Jr., of Harris, Forbes & Company. Frank Milhollan will continue as president and general manager.

Max McGraw, chairman of the board of directors, and Judson Large, secretary and treasurer, will be in charge of major acquisitions and financing.

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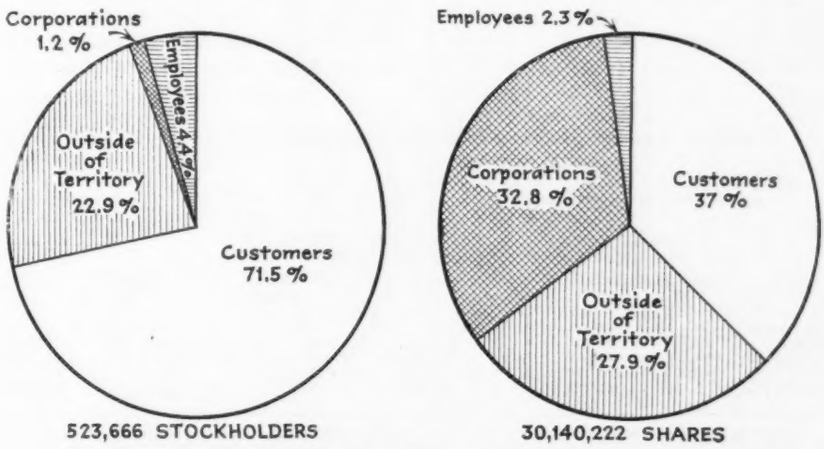
Utilities Owned by the Small Stockholder

ELECTRIC light and power companies are owned by the small stockholder. The customer-ownership committee of the National Electric Light Association, having in hand statistics from 100 companies, covering about a third of the whole industry in the United States, has published a summary from which it appears that more than two-thirds of the shares of these companies are held by customers, employees and persons outside of the territory served. Corporations hold less than a third.

The average holdings per investor in the three groups first named amount to 39.1 shares.

While no definite average value can be assigned to these shares, made up presumably of common and preferred—the latter perhaps including issues at a fraction of the traditional $100 unit—a heavy majority of the stock is evidently in holdings of perhaps $3,000 or smaller.

Comparing 1929 with 1928, customer holdings of this particular group of companies increased 8.5 per cent, em-



Small stockholders are in majority, and hold majority of shares

Average Holdings per Investor

	Stockholders		Shares	
	Number	Per Cent	Number	Per Cent
Employees....	23,197	4.4	699,870	2.3
Customers...	374,526	71.5	11,112,437	37.0
Outside of territory.....	119,896	22.9	8,425,530	27.9
Corporations, etc.....	6,045	1.2	9,902,385	32.8
Totals.....	523,666	100.0	30,140,222	100.0

Average Shares per Stockholder

Employees	30.3	Combined average, 39.1 shares
Customers	29.7	
Outside of territory	70.2	
Corporations, etc	38.1	

ployees' holdings 6.7 per cent, nonresident individual holdings 10.3 and corporation holdings 40.6 per cent. This condition, the report notes, is explained by the preponderance of common stock issues in 1929, whereas the stock which is issued on a customer-ownership basis is usually preferred. In 1928 the shares not held by corporations constituted nearly 73 per cent of the whole number outstanding. The utilities have, in fact, become the property of the small holder. To the extent of nearly 40 per cent the shares of this representative group of companies are held by people in the territory served. Four and one-half per cent of their customers and 18.4 per cent of their employees are stockholders.

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Output of Electrical Energy Continues Low

OUTPUT OF ENERGY by the electric light and power industry continues below that of corresponding periods in 1929, though above that of 1928, according to weekly estimates by the National Electric Light Association. For the week ended October 18 it was 1,710,258,000 kw.-hr. Lately there has been an upturn toward last year's production.

The following table gives the changes, in per cent, for recent weeks, comparing 1930 with 1928 and 1929:

Week Ended	Change from 1929	Change from 1928
September 20	—3.7	+5.7
September 27	—3.2	+5.0
October 4	—5.1	+3.5
October 11	—4.4	+3.2
October 18	+2.7	—3.5

August Revenue Slightly Up from 1929

CENTRAL-STATION revenue continues slightly above the abnormally high marks set each month during 1929, notwithstanding reductions in energy output. Returns for August received by the ELECTRICAL WORLD indicate a total revenue for the entire electric light and power industry in the United States of $168,100,000, a rise of 0.7 per cent from July and of 1.1 per cent compared with August of last year. Despite the small rise from 1929 the revenue is remarkably close to the computed normal, based on past growth. Last year, of course, the normal was considerably exceeded.

Meanwhile the month's operating expenses increased in slightly greater ratio, leaving a small margin of increase in net, compared with 1929. The statistics give no evidence of the extraordinary gain in net earnings indicated by a recent government report on public utility earnings for the same month. That compilation, it should be stated, included various kinds of utilities, whereas the present survey applies to electric light and power only.

The output, slightly over 7,353,000,000 kw.-hr., was a fraction of a per cent greater than in July, but 6.2 per cent less than in August of 1929, and 13 per cent below the estimated normal for the month. Because of prolonged drought only 30.5 per cent came from water power, 14.2 per cent less energy than a year ago coming from that source. Output from fuel was 2.2 per cent less. Compared with July, the water-power output fell off nearly 350,000,000 kw.-hr.; fuel output rose 376,000,000 kw.-hr.

Fuel consumption consequently increased; coal by about 200,000 tons, oil by 60,000 bbl., natural gas by 326,000,000 cu.ft. Compared with August, 1929, only the last-named item increased; the others fell off.

Continued growth in the interchange of energy, presumably intensified this summer because of inadequate water power on certain systems, has brought

Revenue gains scattering—only Middle West raises output

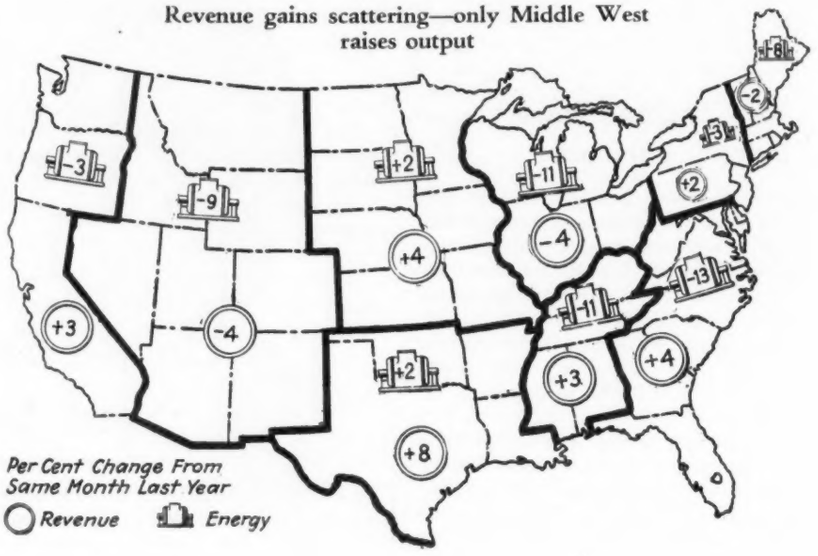


Table I—Central-Station Financial Operations in the United States[1]

Compared with Corresponding Month of Previous Year

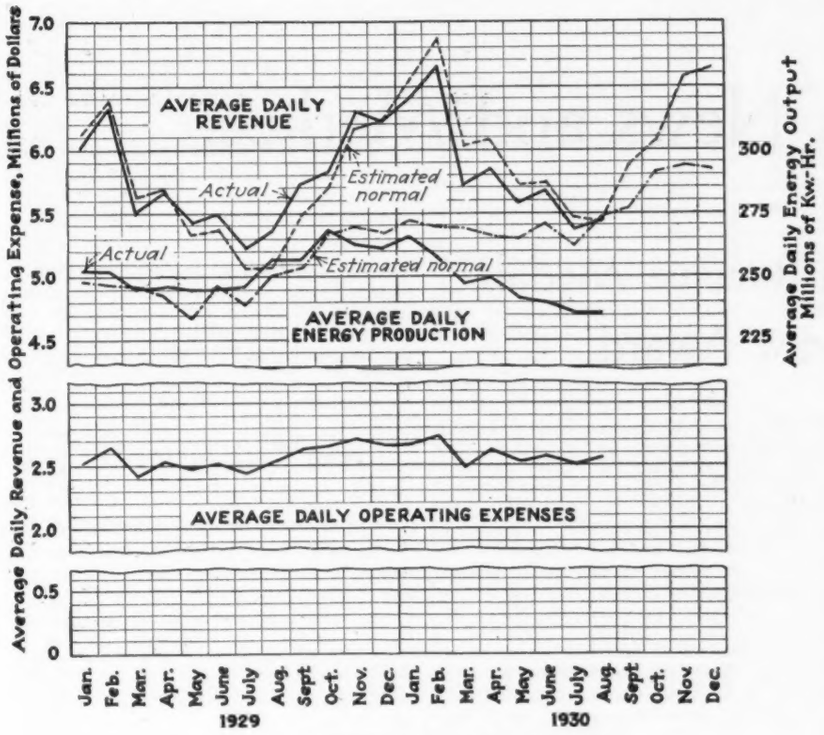
Month	Total Gross Revenue from Sale of Energy*			Total Operating and Maintenance Expense†		
	1930 Thousands	1929 Thousands	Per Cent Inc.	1930 Thousands	1929 Thousands	Per Cent Inc.
May.....	$172,900	$168,400	+2.7	$77,900	$76,200	+2.6
June.....	169,200	165,300	+2.4	76,400	75,650	+1.0
July.....	167,000	162,300	+2.9	77,500	76,000	+2.0
August....	168,100	166,200	+1.1	79,100	78,050	+1.3

Table II—Central-Station Fuel Consumption in the United States‡

Compared with Corresponding Month of Previous Year

Month 1930	Coal		Oil		Gas	
	Short Tons	Per Cent Increase	Barrels	Per Cent Increase	Thousands Cubic Feet	Per Cent Increase
May.....	3,040,644	—1.8	578,532	+2.0	9,595,645	+13.1
June.....	2,954,197	—5.8	592,903	+1.2	9,860,289	+11.9
July.....	3,200,019	—3.6	690,271	+3.9	10,442,989	+18.1
August.....	3,402,062	—6.7	748,408	—1.6	10,769,387	+ 4.4

*Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.
†Do not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions. ‡As collected by U. S. Geological Survey.
(1) The financial statistics for 1929 have been revised as explained on page 665 of the issue of March 29, 1930.



Slack industries cut energy demand

the aggregate purchase of energy by central-station companies close to 2,000,000,000 kw.-hr. monthly.

Not all sections of the country shared equally in the changes. Revenue was lower by 2 to 4 per cent in New England, the East North Central and the Mountain States than in the corresponding month last year; in the other sections it was higher, the maximum gain being in the Southwest, 7.7 per cent.

Output was down in varying amounts everywhere except in the West Central group, where it was up about 2¼ per cent. From water power the production was smaller in every geographical division except New England, where it rose 17 per cent. Here fuel power decreased 15.7 per cent, against 2.2 per cent nationally. It rose 30 per cent in the East South Central States.

Table III—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1930	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
May	7,496,622	—0.3	2,595,645	— 9.7	4,541,472	+5.3	1,755,000	+11.7
June	7,211,608	—1.0	2,764,768	— 3.4	4,446,840	+0.5	1,828,000	+16.8
July	7,326,461	—2.5	2,589,993	— 9.0	4,736,468	+1.3	1,915,000	+18.9
August	7,353,018	—6.2	2,240,558	—14.2	5,112,460	—2.2	1,995,000	+13.5

Table IV—Regional Operations, Revenue and Energy Output in August, 1930

Compared with Corresponding Month of Previous Year

Region	Revenue[1]		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	168,100	+1.1	7,353,018	— 6.2	2,240,558	—14.2	5,112,460	— 2.2
New England	16,200	—2.2	459,232	— 8.2	133,436	+17.2	325,796	—15.7
Middle Atlantic	41,500	+2.4	1,785,970	— 2.9	374,025	— 1.7	1,411,945	— 3.2
East North Central	40,250	—3.6	1,701,353	—10.7	100,543	—31.8	1,600,810	— 9.0
West North Central	14,300	+3.5	492,818	+ 2.3	96,490	—18.6	396,328	+ 9.2
South Atlantic	17,920	+4.1	778,570	—13.4	229,212	—44.7	549,358	+13.2
East South Central	5,820	+2.8	261,432	—11.1	166,604	—24.8	94,828	+30.4
West South Central	10,750	+7.7	462,141	+ 2.2	1,872	—33.4	460,269	+ 2.4
Mountain	4,160	—3.9	308,746	— 9.2	251,041	—10.9	57,705	— 0.5
Pacific	17,200	+2.5	1,102,756	— 2.5	887,335	— 4.8	215,421	+ 8.3

*As collected by U. S. Geological Survey.
(1) The revision of the statistics on revenue is discussed in the issue of March 29, 1930, on page 665.

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Structure Simplification Urged on Bankers

A PLEA FOR FURTHER SIMPLIFICATION of capital structures in the utility industry was made to the Investment Bankers' Association, in convention at New Orleans last week, by Francis E. Frothingham, of Coffin & Burr, Inc., Boston, chairman of the public service securities committee. His report said in part:

While there is a definite tendency toward the simplification of financial structure, many of the groupings in the public utility field are still complicated and involved beyond any apparent reason or need. Your committee has heretofore pointed out the advantages to flow from simplicity in this direction. Complication is not a necessary corollary of size; in fact, the virtues of simplicity of financial structure increase with size and should be constantly sought for as one of the greatest aids to facemark the judgments of values and in the raising of cheap money.

There is a lurking feeling, too, in the public mind that there is something in the pyramiding process not to its best interests. Bankers as well as operators are at fault in this, and we would particularly urge the influence of the bankers toward the correction of the existing confusion of capital structures.

Your committee has also referred in the past to the dangers that lurk in the concealment of intercompany transactions. Here again we are glad to say there is a growing recognition that these necessary and beneficial relationships should be on the frankest basis to the end that they may be removed from the category of public suspicion. Your committee refers here again to these matters because they seem so fundamental in developing sound values back of public utility securities as a class.

The report points out that securities of public utility companies stood the test of the stock market collapse in remarkable fashion.

Henry T. Ferriss of the First National Company, St. Louis, was elected president of the Investment Bankers' Association, succeeding Trowbridge Callaway, of Callaway, Fish & Company, New York. Other officers named for the coming year were: Executive vice-president, Alden H. Little, Chicago; vice-presidents: Charles D. Dickey, Brown Brothers & Company, Philadelphia; William H. Eddy, Chase Securities Corporation, New York City; Bernard W. Ford, Tucker, Hunter, Dulin & Company, San Francisco; Sidney R. Small, Harris, Small & Company, Detroit; William J. Wardall, Bonbright & Company, Chicago; treasurer, William T. Bacon, Bacon, Whipple & Company, Chicago; secretary, C. Longford Felske, Chicago.

Business News and Markets

Adams and Moore Receive Medals Under McGraw Award

THE two manufacturers' medals with purses for 1930 bestowed under the James H. McGraw award were presented at the National Electrical Manufacturers' Association convention at Old Point Comfort, Va., this week. One was given to Lee F. Adams in recognition of his valuable work in the field of standardization and simplification of electrical products. The other was presented to R. W. E. Moore in view of his constructive contribution in the development of codes and standards to control the fire and casualty hazards of electrical apparatus and supplies.

The committee of judges who awarded the medals consisted of Clarence L. Collens, C. H. Strawbridge, W. E. Sprackling, L. B. F. Raycroft, D. R. Bullen and S. L. Nicholson. The committee of awards consists of W. W. Freeman, H. B. Crouse, W. E. Robertson, L. K. Comstock, F. M. Feiker and Earl Whitehorne.

The citations follow:

LEE F. ADAMS, commercial engineer with the General Electric Company, for two and a half years has been chairman of the standards committee of the National Electrical Manufacturers' Association, responsible for the correlation and control of standardization work in the manufacturing branch of the electrical industry and the encouragement and guidance of simplification in manufactured lines. The work has entailed a co-ordination of the standardization policies of the different divisions of the N.E.M.A., as well as relationships with other organizations, the creation of standards in fifty-odd sections of the association, the production of seven handbooks of standards, representation on more than 70 committees in the American Standards Association and joint committees with more than 30 other organizations, much of which he has assumed himself. Throughout this period and through many years of prior activity in standardization work in the Electric Power Club he has carried an arduous and incessant responsibility and made a personal contribution of time, energy and thought that has greatly advanced electrical progress and placed the industry deeply in his debt.

R. W. E. MOORE, engineering manager of association activities for the Westinghouse Electric & Manufacturing Company, has devoted his thought for a long time to the development and promotion of the National Electrical Safety Code and the National Electrical Code, to the end that the use of electrical wiring and equipment might be made less hazardous. For many years as a member of the committee of the Electrical Manufacturers' Council, and since April, 1927, as chairman of the casualty and fire prevention committee of the National Electrical Manufacturers' Association, he has inspired and guided the development, correlation and control of rules, standards, codes, specifications and other regulations affecting the fire or casualty hazards of electrical apparatus and supplies. This has entailed a membership in six committees of the National Fire Prevention Association, eight committees of the American Standards Association and five joint committees with other associations and involved an infinite amount of research, conference, direction and leadership, in which he has continuously and unselfishly given of his time, effort and interest far beyond the measure of the day's work.

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New York Metal Prices

BUSINESS IN THE COPPER MARKET has been dull and the little copper that has been sold in the last week has been for delivery in the first quarter of next year.

	Oct. 15, 1930 Cents per Pound	Oct. 22 1930 Cents per Pound
Copper, electrolytic	10	9½–10
Lead, Am. S. & R. price	5.10	5.10
Antimony	7½	7⅜
Nickel, ingot	35	35
Zinc, spots	4.35	4.30
Tin, straits	25⅛	27.375
Aluminum, 99 per cent.	23.30	23.30

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Almost Million Kilowatts in Large Units Has Gone in Since August

GENERATING capacity of large companies alone has been increased by 890,000 kw. since summer, as shown in the attached tabulation. Adding newly installed generating capacity of the smaller stations throughout the country, the total should easily run well over a million kilowatts.

Large Generators Recently Installed

Steam:

Date	*City*	*Rating, Kw.*	*Kw.*
August	Portland, Ore	35,000	
August	Buffalo, N.Y.	75,000	
August	Tecumseh, Kan	25,000	
October	Milwaukee, Wis	60,000	
October	Pittsburgh, Pa.	60,000	
October	Atlanta, Ga.	75,000	
October	Renton, Wash	70,000	
October	South Amboy, N.J.*	50,000	
October	Oklahoma City, Okla*	30,000	
October	Brooklyn, N.Y.	110,000	
Total		590,000	590,000

Water Power:

Date	*Plant*	*Rating, Hp*	
August	Waterville, N.C.	108,000	
September	Fifteen-Mile Falls, N.H.-Vt.†	200,000	
October	Saluda River*, S.C.	111,000	
Total		419,000 =	300,000
Grand Total			**890,000**

*On point of going into operation. †Serving Massachusetts largely.

Westinghouse Orders Reflect Depressed Trade

A DECLINE OF 14 per cent is shown in sales billed and of 28.5 per cent in orders received by the Westinghouse Electric & Manufacturing Company during the past nine months. The totals, however, do not include radio receiving sets and tubes, the manufacture of which was transferred as of January 1, 1930, to the Radio Corporation of America. The income from sales of

	1930	1929
Orders received	$132,715,293	$185,625,135
Sales billed	137,446,908	159,545,778
Net income after depreciation, reserves and taxes	11,355,619	19,796,819
Interest charges	3,375	252,608
Balance available	*11,352,244	19,544,211

*Equal to $4.25 per share on the outstanding preferred and common stocks.

receiving sets and tubes now being distributed under the Westinghouse name will be included in the net income. For products other than radio, orders received during the nine months' period of 1930, compared with the corresponding period of 1929, show a decrease of 17 per cent from 1929 and an increase of 8 per cent over 1928.

Earnings figures covering the first three quarters of the past two years are given in the accompanying table.

Electrical Manufacturing Drops Slightly

A DECLINE of 1.5 per cent in September compared with August is shown by the returns of energy consumption by electrical manufacturing establishments, indicating a slight reduction in the manufacturing activity of this class of establishment. The present level is intermediate between that of July, the lowest month in more than a year, and August, which was 2.5 per cent higher.

Compared with 1929 the September level this year is down 11.1 per cent, but for the first nine months the average in the two years is almost identical. During the first four months 1930 was ahead of 1929; during the next five the movement was downward this year, while last year there was an increase, the rise from August to September being especially large.

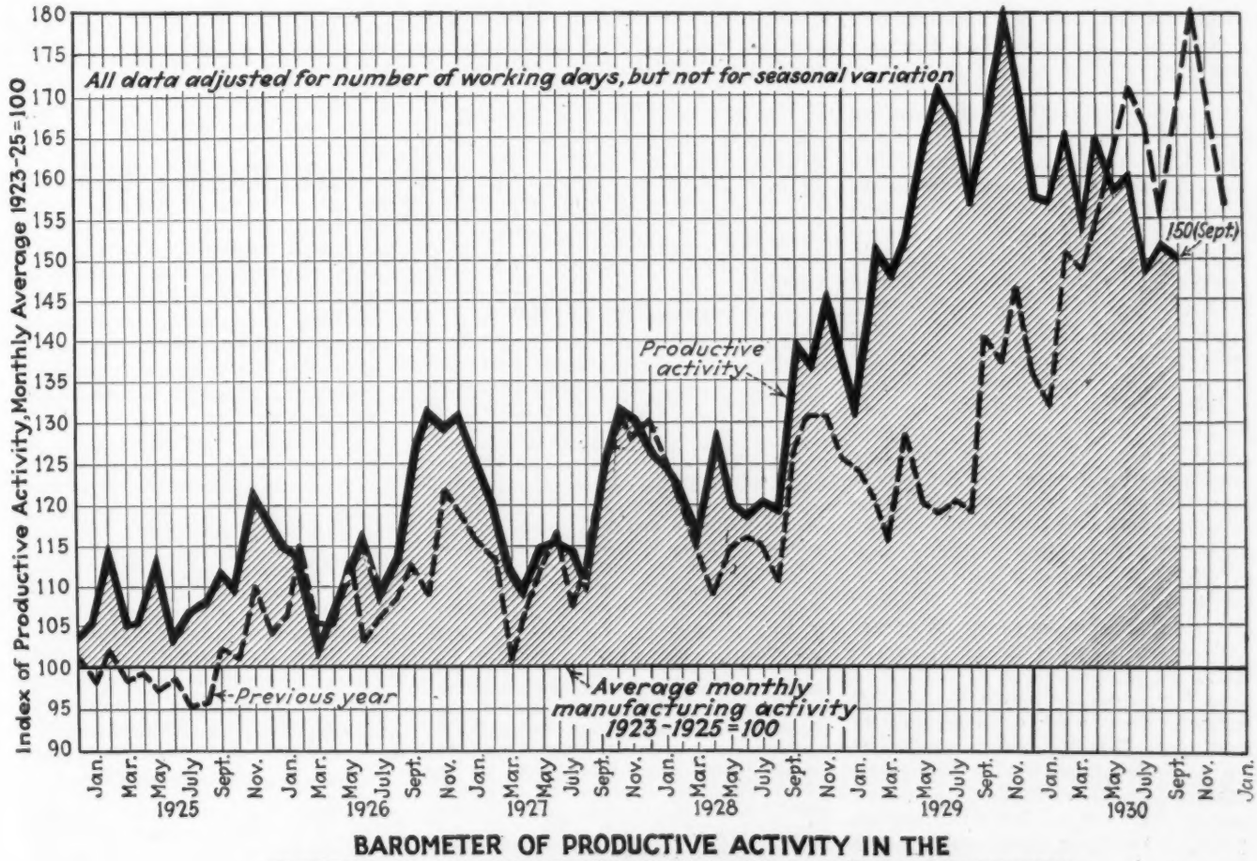
Taken as a group the smaller establishments did somewhat better than the larger, but the difference is not great. Much more noticeable is the variation between branches of electrical manufacturing, in so far as the returns permit of this type of analysis. Some lines show a definite improvement. Among them are the production of household appliances and radio apparatus; gains are indicated also in the general field of measuring apparatus. But, so far as it can be segregated, heavy equipment did not do so well.

The inference is that manufacturers for the residential consumer feel warranted in speeding production, while those primarily supplying the industries and dependent on sales for replacements, electrification and expansion of manufacturing facilities continue on a light schedule.

The conclusions are in harmony with those drawn from independent data. It is known that the residential load per customer has risen sharply within the year, indicating a growing use of electrical appliances. But with many manufacturing plants running far below capacity the industrial market is necessarily slow.

Index of Electrical Manufacturing

September, 1930	150.0
August, 1930	152.2
July, 1930	148.5
June, 1930	160.2
September, 1929	168.8
August, 1929	155.4
First nine months of 1930	156.2
First nine months of 1929	156.8



BAROMETER OF PRODUCTIVE ACTIVITY IN THE ELECTRICAL MANUFACTURING PLANTS OF THE UNITED STATES

Market Conditions

EQUIPMENT buying in the Eastern district is still below normal, but the upward trend noted last week is sustained. Small equipment is moving fairly well in New England and the Southeast.

——PACIFIC COAST BUSINESS CONTINUES TO SHOW SOME ENCOURAGEMENT, but standard items are still well below normal.

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EASTERN

—BUSINESS HOLDS ON A *more encouraging trend in the electrical equipment market in the Eastern district, and while buying is subnormal for this time of year, there is an upward swing to a higher level that is helping the situation. Central stations are fairly well identified with current sales, with the bulk of orders centered in transformers and other substation apparatus.*

—INDUSTRIALS SHOW SIGNS *of more life, based on the rate of inquiries as compared with this time last month; actual maturity of sizable account, however, continues indefinite. Lighting equipment is securing better attention and some worthwhile business in that line is anticipated at an early date.*

A metropolitan utility company has placed an order for transformers with a New York manufacturer totaling $75,000. Another central station in northern New York has closed with the same maker for similar equipment and accessory apparatus to a sum of $35,000. The Newport News Shipbuilding & Dry Dock Company will furnish a 6,000-hp. hydraulic turbine unit, with complete auxiliary equipment, for the Shoshone power project of the Bureau of Reclamation in Wyoming at a price of $53,750. A manufacturer of turbo-generators, Diesel engines and other primary power equipment at Philadelphia says that business for the first nine months of the year shows an advance over the corresponding period of 1929 by about 12 per cent, with outlook for the remainder of the year distinctly favorable. A Pittsburgh manufacturer has secured an order for a motor-generator set, exciter and accessory equipment for an installation in Kansas. A maker in New York has taken a contract for a Diesel engine-generator set for a municipal project in Minnesota, totaling $39,750, the order for exciter, switchboard and auxiliaries going to another New York maker.

Industrial account shows the best prospects in the iron and steel and affiliated metal-working fields, with chemical and food project enterprises coming along in more substantial fashion. A manufacturer of electric washing machines in northern New York has given an order for fractional-horsepower motors to an amount of $40,000. A maker of air-conditioning apparatus in New Jersey has placed a $120,000 contract for centrifugal compressor units with a New York manufacturer, representing a record order for equipment of this kind for some months past. Inquiries are more brisk from the steel-working centers in western Pennsylvania and eastern Ohio, covering for the most part heavy duty motors, electrical drives, controls, etc., and some desirable commitments are looked for from that quarter.

A manufacturer of electrical switches and controls for heavy service reports business as slow, with shipments at the present time under those of the spring season. A maker of electric batteries in northern New York is securing a substantial round of orders, with sales in September developing a new high record in the history of the organization. The General Railway Signal Company has secured an order for equipment for the New York subway system, totaling $269,140.

CONSTRUCTION PROJECTS

Signal Supply Officer, Army Base, Brooklyn, N. Y., will receive bids until November 7 for wire in quantities up to 10,000 miles (Circular 38). Board of Education, New York, plans vocational training shops in proposed Bronx Continuation School to cost $1,100,000, for which bids will soon be asked. Standard Oil Company of New York, Buffalo, N. Y., plans oil storage and distributing plant at Dunkirk, N. Y., to cost $200,000. Radio Corporation of America, New York, will take bids in November for broadcasting station, power house and other structures at New Brunswick, N. J., to cost over $1,000,000. Department of Institutions and Agencies, Trenton, N. J., will receive bids until October 29 for water-tube boilers and mechanical stokers. Bureau of Supplies and Accounts, Washington, D. C., will receive bids until November 4 for storage batteries and spare parts for the Philadelphia, Pa., navy yard (Schedule 4308). Board of District Commissioners, Washington, D. C., will receive bids until October 29 for quantity of composite signal and telephone cable, also, until November 15, for coal-handling equipment, etc.

SOUTHWEST

—THE COOLER WEATHER *of the past week seems to have reacted favorably on some lines of the electrical industry. Although actual shipments have not increased, the tone is slightly better and more inquiries have been received.*

Contracts closed since last report include two 25,000-kva. synchronous condensers and three 6,900/132,000-volt transformers rated at 12,000 kva. each self-cooled and at 18,750 kva. when cooled with fans. This apparatus is for use on the transmission lines of a large hydro-electric development and will cost $250,000. Also a switchboard for an Arkansas water power plant costing $22,000 and a lot of medium-sized motors with control to cost $5,000 for an addition to a local factory.

CONSTRUCTION PROJECTS

Phillips Petroleum Company, St. Louis, Mo., plans oil terminal and distributing plant at East St. Louis, Ill., to cost over $2,000,000. St. Louis Screw & Bolt Company, St. Louis, Mo., will soon begin erection of plant to cost about $200,000. Arkansas Power & Light Company, Little Rock, Ark., plans power substation at El Dorado, Ark., to cost $65,000. Little Rock and Batesville, Ark., plan ornamental lighting systems. Temple, Tex., plans addition to ornamental lighting system. Louisiana & Arkansas Railway Company, New Orleans, La., plans terminal warehouse at New Orleans, to cost over $3,000,000. Opelousas, La., contemplates an ornamental lighting system.

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MIDDLE WEST

—BUSINESS IN THE MIDDLE WEST *section is much the same as last week. No marked improvement has been made; neither has any further recession been noted. Indications seem to be that business as a whole is making some improvement, although the recovery is admittedly slow and uncertain.*

Major activities are marking time, willing to expand with the slightest increased demand. Renewed purchasing of equipment in the railroad industry is encouraging, while the automotive industry appears to be in a somewhat better position. Retail trade shows a slight improvement. The various utility companies are conservatively proceeding with fall construction programs, and while the demand for equipment and apparatus is light, maintenance purchasing is quite heavy.

CONSTRUCTION PROJECTS

Wisconsin Gas & Electric Company, Racine, Wis., plans converter station. Forest Products Laboratory, Madison, Wis., plans laboratory unit to cost over $500,000. Madison, Wis., plans an ornamental light-

ing system. Kalamazoo Stationery Company, Kalamazoo, Mich., contemplates addition to cost over $100,000. Consumers Power Company, Jackson, Mich., has filed plans for an equipment plant at Pontiac, Mich. Baraga County Light & Power Company, Baraga, Mich., plans hydro-electric generating plant on Sturgeon River to cost over $150,000. Commanding Officer, Air Corps, Chanute Field, Rantoul, Ill., will receive bids until November 1 for quantity of 25-kva. transformers (Circular 11). Chicago-Northwestern Railroad Company, Chicago, Ill., will build a warehouse and freight terminal to cost $2,000,000. Capitol Motor Inn, Indianapolis, Ind., plans automobile service, repair and garage building to cost $250,000. University of Cincinnati, Cincinnati, Ohio, plans central shop and warehouse to cost $100,000, also a chemistry and physics building to cost $400,000. Otter Tail Power Company, Fergus Falls, Minn., plans power transmission lines at Rock Lake and Bordulac, N. D. Central West Public Service Company, Omaha, Neb., plans power transmission line at Chamberlain, S. D. American Utilities Corporation, Des Moines, Iowa, plans transmission line at Burlington, Iowa.

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SOUTHEAST

—ACTIVITIES IN THE SOUTHEAST *were quiet last week, with what business reported coming from the industrial field. Radio equipment sales are brisk and appliance sales by central stations are good.*

Elevator equipment worth $15,000 was ordered for an office building under construction in Atlanta. Crusher equipment amounting to $10,000 was ordered in Tennessee, while a $5,500 motor and pumping equipment order came from Georgia. There is in more or less immediate prospect orders for textile motors and control equipment for a western Georgia mill and contracts are expected to be let this week on a middle Georgia textile electrification project which will involve $20,000 in motors and wiring materials and $10,000 in substation and line. Street-lighting equipment totaling $7,000 was ordered last week for a Tennessee town. A Georgia company recently completed a four-week campaign in which refrigerators amounting to $390,000 were sold.

CONSTRUCTION PROJECTS

Great Atlantic & Pacific Tea Company, New York, plans storage and distributing plant at Richmond, Va., to cost $100,000. West Virginia Super-Fuel Company, Moundsville, W. Va., plans addition to fuel briquette and distillation plant to cost over $100,000. Wheeling, W. Va., plans airport lighting system on municipal airport to cost over $600,000. Shelby County Commissioners, Memphis, Tenn., plans equipment and repair plant at Mullins Station to cost over $100,000. Brown, Greer & Co., Knoxville, Tenn., plans baking plant to cost $200,000. Florida Power Corporation, St. Petersburg, Fla., contemplates extensions in transmission lines in vicinity of Apalachicola, Fla.

PACIFIC COAST

—BUSINESS CONTINUES FAIR, *with an increasing amount of construction reported from interior cities, much major construction is projected and several large buildings are close to the figuring stage, such as certain mills and buildings in the Bay area.*

—PESSIMISM IS VANISHING *before the prospect of good crop money and the feeling that all possible is being done to cope with a situation that is beyond individual power.*

Winter means an aggravated unemployment situation and San Francisco, for example, with $750,000 worth of municipal construction hastened, is preparing to alleviate it. Collections have slipped a few days, very vigorous follow-up is necessary, but prices on the whole have been remarkably steady considering hand-to-mouth buying and increase in number of small contractors. Machinery manufacturers report a subnormal demand for such staples as distributing transformers, small motors and meters.

Outstanding orders during the past week have included a $90,000 Westinghouse turbo-generator set for a San Francisco steamship line, a $15,000 current-regulating outfit for the city of Los Angeles, a $4,500 General Electric switchboard for Monterey and a $25,000 Westinghouse distributing generator outfit for Salt Lake City. Appliances are moving fairly well, especially small washers, vacuum cleaners and ranges. Educational institution building is very brisk and includes a $2,000,000 memorial library for the University of Southern California, a $500,000 auditorium for Claremont and general razing of old structures on the University of California campus at Berkeley, preceding a general remodeling. Miscellaneous orders include a carload of 32-in. crossarm braces, an assorted carload of ground rods, mastarms and miscellaneous hardware, and cable orders from southern California for rubber, lead and varnished cambric styles.

Adverse opinions regarding business conditions and immediate prospects for betterment are voiced by Seattle jobbers, but the movement last week tends to corroborate contrary views. Sales were light and scattered, as were inquiries, the movement reported including only fourteen motors from 30 hp. down to lumber mills, twenty from 50 hp. down to dealers, ten from 75 hp. down to pulp and paper mills and about sixteen from 40 hp. down to miscellaneous sources. St. Helens Pulp & Paper Company, St. Helens, Ore., is constructing a $500,000 addition involving electrical apparatus and machinery, and the Dumwamish Lumber Company's mill in Seattle, recently destroyed by fire, with loss of approximately $150,000, is to be rebuilt.

CONSTRUCTION PROJECTS

Metropolitan Water District, Los Angeles, Calif., plans hydro-electric power project on Colorado River in California-Arizona, to develop capacity of 136,000 hp. Sunland Sulphur Company, Fresno, Calif., has plans for a mill between Fresno and Calwa, estimated to cost $100,000. Los Angeles, Red Bluff, San Diego, Visalia, Santa Ana, and Alturas, Calif., plan ornamental lighting systems. Pacific Gas & Electric Company, San Francisco, Calif., will make extensions and improvements in high-tension transmission lines and stations at Stockton, Calif., to cost about $300,000. Oregon Pulp & Paper Company, Salem, Ore., plans addition to cost over $100,000. Ford Motor Company, Dearborn, Mich., will soon begin construction of an assembling plant at Seattle, Wash., to cost close to $2,500,000. Great Northern Railway Company, St. Paul, Minn., plans power plants at Great Falls and Whitefish, Mont., each to cost about $85,000.

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NEW ENGLAND

—CONTINUED SMALL LOT BUYING *of industrial equipment and steadiness in the demand for domestic appliances mark the trend in this district. Slight gains in industrial activity appear in the reopening of shops and projected plans for production as announced by a number of manufacturers.*

Small motor sales are steady, though on a volume basis below that of last year. Sales of fractional-horsepower motors, according to one prominent manufacturer, have been gaining recently and steady shipments have been made to manufacturers of heating equipment, refrigerators and domestic appliances. Heavy electrical equipment sales are quiet. A number of 50-hp. motors were recently ordered by an eastern Massachusetts manufacturer. Switch and control equipment orders are spotty and general scheduled materials are in less demand. While the movement of industrial equipment has been slow, on the other hand, domestic appliance sales in this district have been steady and reflect, according to one group of central stations, a gain of 20 per cent in power consumption for the past month as compared with last year.

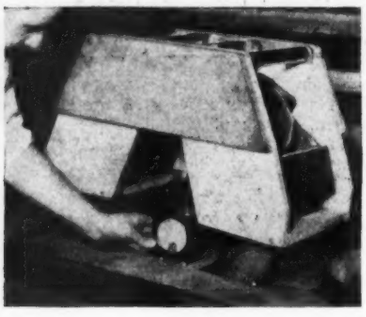
CONSTRUCTION PROJECTS

Edison Electric Illuminating Company, Boston, Mass., has filed plans for extensions and improvements in power substation on Atlantic Avenue. Northeastern Storage & Distribution Company, Worcester, Mass., plans terminal and warehouse to cost $1,000,000. Colonel E. H. Green, New Bedford, Mass., contemplates power plant at Round Hills radio station. New England Telephone & Telegraph Company plans to expend $1,753,525 for new improvements.

New Equipment Available

Apparatus Tests Welds Without Destroying Them

MAGNETIC METHODS OF TESTING butt welds without destroying them and easily portable apparatus for applying the methods have been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The tests are made by "bridging" the



welded seam with a large horseshoe electro-magnet and exploring the magnetic field in the vicinity of the weld with a meter.

The quality of the weld is readily determined by passing the meter over it and watching the pointer. The meter indicates the reluctance of the joint by reading the magnetizing forces across it as compared with the magnetizing forces of the steel plate in which the weld is made.

This method is practically indifferent to the depth of the fault and is only slightly affected by a rough, uneven surface. Very little skill and training on the part of a tester are necessary, as the meter tells the story.

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Foot-Operated Machine Strips Insulated Wires

PEDESTAL TYPE, FOOT-OPERATED, wire strippers designed for the rapid removal of insulation from the finer types of wire are announced by the Ideal Commutator Dresser Company, Sycamore, Ill. These machines do end or center stripping on either single or duplex cord.

The same pedal movement grips the wire, cuts the insulation and strips it off. The device is equipped with interchangeable blades of either single "V" notch for single conductor or double "V" notch for duplex cord. The size of the stripping hole in the blades is increased or decreased by a micrometer screw adjustment with a lock nut. The machine may be moved conveniently from place to place or mounted on a bench. The bench space required for it is 8x12 in., while the floor space needed is 18x18 in. The unit weighs 25 lb.

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Automatic Controller for Multi-Speed Motors

AUTOMATIC CONTROLLERS FOR two-speed, consequent pole type (reconnected) squirrel-cage motors are announced by Cutler-Hammer Inc., Milwaukee, Wis. These multi-speed controllers, Bulletin 9739, function to start the motor and change the speed by reconnecting the motor winding. They provide thermal overload protection and both motor speeds are furnished with low-voltage protection. A separate push-button master switch with "stop," "low" and "high" buttons provides three-wire remote control.

These new controllers are furnished for constant-horsepower, constant-torque or variable-torque motors. A sequence-compelling feature can be obtained with the device. The entire mechanism is mounted on a single slate panel which is easily removed from the case. A split case provides easy access to all parts.

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Automatic Water Heater Uses Off-Peak Energy

AUTOMATIC WATER HEATERS which use off-peak electricity and which are especially adapted for homes, apartments, hospitals, barber shops, beauty parlors, etc., are announced by the Hall Electric Heating Company, Inc., Philadelphia. This new unit heats the water to a high temperature and stores it like a huge thermos bottle.

When steaming water is drawn from the heater tank it is automatically mixed with cold water direct from the mains by means of a specially designed mixing valve. This reduces the water to a usable temperature and, according to the manufacturer, actually multiplies the capacity of the tank.

The tank is thoroughly insulated with balsam wool. The outside shell is made of 20-in. U. S. standard steel baked with one coat of japan and finished with gray and green enamel. Each tank is guaranteed to withstand a working pressure of 85 lb. per square inch.

Insulation Prevents Formation of Ozone

RUBBER INSULATION which is asserted to entirely do away with corona and ozone troubles that are common on high-voltage cables insulated with rubber compounds is announced by the Simplex Wire & Cable Company, Boston.

This new insulation, known as "Anoroc," is said absolutely to prevent the formation of ozone in or about a cable at normal operating voltage, thereby removing the only objection which exists to rubber insulation. It has, according to the manufacturer, all of the electrical, chemical and physical characteristics which have made rubber the most adaptable and desirable insulation for cables.

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PANEL-GUTTER TAPS comprising two pieces that are clamped on to the cable with socket screws set flush with the surface of the connector and made for tightening with a wrench are announced by the Frankel Connector Company, Inc., New York. Splices made with these connectors have no protruding points and no sharp corners, but are, the manufacturer says, compact and easy to tape.

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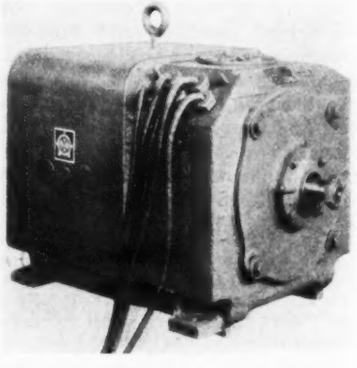
Explosion-Proof Motor for Use in Coal Mines

EXPLOSION-PROOF MOTORS in sizes required by coal loaders, coal cutters and other coal mining machinery are announced by the Reliance Electric & Engineering Company, Cleveland, Ohio.



These machines are designed for operation on direct current.

The construction of these motors is such that even if an explosive mixture of natural gas and air should leak inside, ignite and explode, the motor will withstand the explosion and not communicate sparks or flame to the air outside.